Chapter One : The Indian Logic Tradition

Misinterpretation, misrepresentation and vague statements are the most common causes of conflict and deception. In Indian mythology, powerful *daityas* (demons) were destroyed because they were not precise enough when asking for boons! The demon भस्मासुर got a boon from Lord Shiva that anyone whose head he touches with his hand would immediately burn to ashes! To save the world, Lord Vishnu took the mōhinī avatāra, and tricked him into putting his hand on his own head! If only he had added the clause, "anyone but myself"!

Hiraṇyakaśipu thought he would play smart, and prayed to Brahma, "May I not be killed by any human or animal, nor within or outside any residence, nor at day or night, nor on Earth or in space, nor by any weapon!" Once again, Vishnu takes the avatar of *narasiṁha*, who is neither human nor animal; *at twilight*, which is neither Night nor Day, and at *the threshold of the house*, which is neither inside nor outside, puts *Hiraṇyakaśipu on his lap*, which is neither on Earth nor in space, and *with his nails*, which are not a weapon, tears open his stomach!

Deception is nothing new. In ancient times during *mahābhārata* war, the Kuru commander and *aśvatthāmā's* father *drōṇa* was killing vast numbers of *pāṇḍava* troops. To make him drop arms, the *pāṇḍavas* hatch a plot to shout "*aśvatthāmā* is dead!" *bhīma* kills an elephant in the Kuru army who is also named *aśvatthāmā*, and shouts as

“अश्वत्थामा हतो हतः”. But *drōṇa* asks *yudhiṣṭhira* for confirmation, knowing that he, the very son of *dharma* would never lie. *yudhiṣṭhira* says, “अश्वत्थामा हतो....” and adds softly, “नरो वा कुञ्जरो वा” (either man or elephant!). *drōṇa* is deceived, drops his arms, and technically speaking, no one violates the rules of *dharma*!

Several recent military disasters can be attributed to miscommunication. In the Crimean war of 1854, Lord Raglan intended a British Light cavalry to raid a Russian artillery battery. However, due to miscommunication at some level, it was sent instead into a suicidal attack into a different assembly of Russian gunners! A more precise order from Raglan would have saved the British army from heavy casualties.

During the Vietnam War, there was a serious miscommunication between the United States and Vietnam. The US government sent messages to the government in Hanoi “with the threat of continuing the bombing of North Vietnamese positions unless they would stop supplying partisans in South Vietnam, during the Vietnam War. The message did not give the North Vietnamese a clear understanding of what they should do in order for the bombing to stop. They realized that if they stopped all the supplies, the US would stop the bombing. However, they also knew that "this was more than the situation required," but they did not know "how much more" (p. 47). The US, in an attempt to be reasonable, was asking for gradual reduction in supplies. However, the way the message was formulated, made it sound to North Vietnamese that they would be bombed anyway. The lack of success with the bombing message made US officials feel that the same fate would follow

the cease-fire proposal. As a result, it was not offered and the war continued. Thus, it would have been beneficial for conflict de-escalation if the US has not based its decisions upon its own message, but upon the interpretation of it by the opponent." ((Fisher, Kopelman, & Schneider, 1994, pp. 43-49), summarised by Mariya Yevsyukova)

If miscommunication leads to such disasters, surely, there must be some way to avoid it? Indian logicians have given much thought to this question. In India, debates between the different philosophical schools were common. Debates are meaningful only when the opponents are honest and don't cheat. They are efficient when there is no waste of time in clarifying one's position, when there are no logical flaws in the arguments. The logicians' focus on accurate communication was therefore, in that context. Indian philosophers were extremely particular about the efficiency and conclusiveness of these debates, and invented an elegant method of countering the opponent's point of view. It consists of two parts: पूर्वपक्ष and उत्तरपक्ष (also called सिद्धान्त). In the पूर्वपक्ष, the debater, having fully understood the opponent's position, gives a detailed account of the opponent's arguments. So much so, that he gives additional arguments and examples in its support to make the strongest possible case in support of the opponent. Then in the उत्तरपक्ष, he refutes all of the opponent's arguments one by one, and finally establishes his own position, called सिद्धान्त (proven end). The argumentation proceeds on mutually acceptable grounds agreed upon by both parties a priori. By virtue of this structure itself, many of the problems of logical fallacy and misrepresentation are avoided. But even without resorting to dishonest means, a healthy debate may fail to reach a conclusion because the arguments are vague,

or because there are logical fallacies like circularity or infinite recursion.

In this book we introduce the न्यायदर्शन, which has a long, living, and interesting history of at least 2000 years. The Sanskrit word for logic is न्याय, and the philosophy that deals with it is called न्यायदर्शन. In the very first aphorism of the न्याय सूत्रs, which is the oldest extant treatise on logic, the सूत्रकार says,

प्रमाणप्रमेयसंशयप्रयोजनदृष्टान्तसिद्धान्तावयवतर्कनिर्णयवादजल्प-
वितण्डाहेत्वाभासच्छलजातिनिग्रहस्थानानां तत्त्वज्ञानान्निःश्रेयसाधिगमः ॥ १ ॥

The attainment of niḥśrēyasa (the ultimate cessation of suffering) is by the knowledge about the true nature of sixteen categories:

1. प्रमाण – The means of right knowledge
2. प्रमेय – The object of right knowledge
3. संशय – Dilemma. A state of cognition in which the mind is confused between two conflicting views: Is this a serpent or a rope?
4. प्रयोजन – Purpose
5. दृष्टान्त – A commonly accepted and familiar example, to explain arguments better
6. सिद्धान्त – An axiomatic tenet on which the entire theory rests. For example, "The elements are different because their atoms are different".
7. अवयव – The components of inference. In the न्याय system, they are 1) प्रतिज्ञा (statements), 2) हेतुः (reason), 3) उदाहरणम् (universal proposition with an example), 4) उपनयः

(bringing universal proposition into present context) and 5) निगमनम् (conclusion)

8. तर्क – The process of cross questioning that leads to a conclusion
9. निर्णय – Conclusion, i.e. the correct inference obtained either by तर्क or other means
10. वाद – A debate between two opponents on certain common grounds without prejudice
11. जल्प – The use of dishonest means to defeat each other in debate
12. वितण्डा – Destructive criticism, where one seeks to refute the opponent without establishing one's own position
13. हेत्वाभास – Reasoning which is logically correct, but applied to physically impossible scenarios. This is a feature of reasoning unique to Indian philosophy.
14. छल – Deliberate misinterpretation or trickery meant to cheat the opponent
15. जाति – Making general conclusions on false analogy.
16. निग्रहस्थान – The points of the opponent's defeat

Indeed, so deeply were Indian logicians involved with issues surrounding reasoning that they believed that only by correctly understanding the sixteen elements of reasoning and debate, one can achieve the ultimate cessation of suffering and attainment of supreme bliss (निःश्रेयस)! The very second *sūtra* says:

दुःखजन्मप्रवृत्तिदोषमिथ्याज्ञानानामुत्तरोत्तरापाये तदनन्तरापायादपवर्गः ॥ २ ॥

By successively dispelling false conceptions, bad character, rebirth and misery – the disappearance of one allowing the disappearance of the next – one can achieve final liberation.

Indian logic passed through two broad phases: The first phase is प्राचीनन्याय or Ancient Logic, which starts with the न्यायसूत्रs and continues up to the 10th century AD. The second is नव्यन्याय or Neo-Logic, which begins around 12th century AD and continues till date. The प्राचीनन्याय was more issue oriented, and discusses with great rigour the means of attaining valid knowledge (प्रमाणs), a unique five-part method of inference, and types of logical errors. नव्यन्याय, on the other hand, focused on methodology. *Mahāmahōpādhyāya mahēścandra nyāyaratna* rightly says, "A hair-splitting subtlety in the discussion of meanings of terms is the distinguishing characteristic of modern Nyáya." (Nyayaratna, 1963) The focus of the neo-Logicians (*navyanaiyāyikas*) was to formulate a new meta-language for precise communication, free from the fallacies of natural language.

A short anecdote from the biography of आचार्य शंकर can be used to demonstrate the power of the नव्यन्याय language. As a philosopher and a poet, a mystic and religious reformer, a savant and a saint, आचार्य शंकर was one of the greatest philosophers the world has ever seen. In his biography called "शंकरदिग्विजय", श्री विद्यारण्य gives a humorous description of शंकराचार्य's first meet with a great मीमांसा philosopher named मण्डनमिश्र. At that rather unwelcoming meeting, the conversation went thus:

मन्डनः - कुतो मुण्डी ?
शंकरः - आगलान्मुण्डी !
मन्डनः - पन्थास्ते पृच्छयते मया ।
शंकरः - किमाह पन्थाः ?

मन्डनः - त्वन्माता मुण्डा इत्याह !
शंकरः - तथैव हि ।
मन्डनः - अहो पीता किमु सुरा ?
शंकरः - नैव श्वेता यतः स्मर ।
मन्डनः - किं त्वं जानासि तद्वर्णम् ?
शंकरः - अहं वर्णं भवान् रसम् !
(शंकरदिग्विजयः - ८.१६, ८.१८)

The story goes thus: Mandana Mishra was a philosopher of the मीमांसा school. When Shankaracharya reached his house, it was locked from inside. He used Yogic powers to enter the house. Inside, Mandana Mishra was busy performing a Shraddha ritual. Being an ardent ritualist, he had a strong dislike for Sanyasins. Seeing a Sanyasin thus entering his locked house uninvited, he asked him angrily, "कुतो मुण्डी?", "Whence do you come, o shaved one?" Shankara, seeing the insulting sarcasm in the words, deliberately misinterpreted the word "कुतो" to mean "till where", and replied, "आगलान्मुण्डी", "shaved till the neck only"! Mandana, angered by such a reply, said, "I asked the road!" Shankara asked mockingly, "What did the road say?" Mandana, even more angered, replied, "It said your mother is head-shaven (मुण्डा)!" Shankara, taking it to mean that the road told Mandana that *Mandana's* mother is head-shaven, just said, "That's right!" By this time, Mandana had lost his temper, and asked, "अहो पीता किमु सुरा?", "(Have you) drunk wine?" Again, Shankara interpreted the word "पीता" (drunk) as yellow to mean 'is wine yellow', and said, "No, recall that it is white!" Then in an attempt to pull his leg,

Mandana replied, "I see, you know its colour!" implying that Shankara was well acquainted with wine! Shankara, too witty to argue against, said, "I know its colour only, you know its taste!"

At this point, the sages assembled at Mandana's house intervened and resolved the verbal fight, and asked Mandana to receive Shankara as per the Dharmic rules and give him Bhiksha. Shankara, of course, had come to challenge Mandana Mishra in debate: on the next day, the world witnessed one of the most legendary debates in the history of philosophy where the two giants of Vedanta and Mimamsa came face to face!

As is well known, मण्डनमिश्र lost in debate, but gained immortality in the pages of history as सुरेश्वराचार्य, one of शंकराचार्य's four principle disciples.

Now you would immediately point out, and rightly so, that this was not really a debate, it was just two persons pulling each other's legs! The arguments involved deliberate misinterpretation of the words of the opponent. If you remember, the Nyaya system already classifies such arguments as छल, which is a flawed way of reasoning. Here, the intention of the poet is not to show any serious quarrel, but to show शंकर's wittiness in a humorous manner. He *intends* to make the misinterpretations very evident. Nonetheless, had the नव्यन्याय language been used for the above conversation, there would have been no scope for misinterpretation. This is how:

When शंकराचार्य replied to मण्डन's first question with छल as "आगलान्मुण्डी", मण्डन clarified his intention in verbal संस्कृत, which once again, gave शंकर a chance to use छल. Instead, he could have used the नव्यन्याय language thus:

> "छलेन निगृहितोऽसि । अध्याहृतागमनक्रियानिरूपितापादानत्वविशिष्टवाचिका पञ्चमी, न तु मुण्डत्वावधिवाचिका",

which is a technical way to say in unambiguous terms, "the form of the word 'कुतः' used by me was to qualify the implicit verb of 'coming' which denotes separation, and not to qualify the boundary of shave!" Then शंकर would have had no other option but to respond correctly, and the entire series of further छलs would have been avoided. Even if we assume that मण्डन had not realized the छल at this step, it was used once again in the reply to "पन्थास्ते पृच्छते मया". There at least, he could have used to नव्यन्याय language to clarify:

> "पुनः छलः! पन्थाः प्रश्नक्रियायाः अप्रधानकर्म न तु प्रधानकर्म!" (प्रच्छधतोः द्विकर्मकत्वात् तत्र मार्गस्य अप्रधानकर्मत्वम् ।)

which means, "the road is not intended to be the primary object of the action of asking". In this way, at every point, मण्डनमिश्र could have stopped शंकर's deliberate misinterpretations.

Unfortunately, after the advent of colonialism, the popularity of Nyaya and most other Indian philosophies began to decline. Thankfully, it survived in at least a few traditional institutions.

Nevertheless, truly intellectual work never becomes obsolete, and it is no surprise that what was relevant in verbal language processing in those times; is being re-invented in the context of computerized language processing today! Indeed, the नव्यन्याय language, coupled with the theories of Indian grammarians, is increasingly being applied in areas like language independent sentence parsing, language independent grammar, and even in cognitive science.

Chapter Two : The Language of नव्यन्याय

Welcome to Chapter Two!

Did you know how the वैशेषिकs arrived at the concept of the Atom? Or how do the नैयायिकs argue for the existence of the Soul (आत्मा)? How can Indian philosophers accept the testimony of the scriptures as valid means of knowledge (शब्दप्रमाण) and yet maintain rationality in their philosophy?

Panic not, for we shall return to these questions soon. But for a while, we must put our curiosity on hold, and learn to speak in the language of नव्यन्याय. As we move on, we will discover that this language is not merely a language, but it provides us with fascinating tools to explore many problems in modern science and philosophy.

As we have seen, the reason that नैयायिकs developed their own language in the first place was for unambiguous knowledge representation in debate. After the 16th century, all literature ranging from वेदान्त to साहित्य used the नव्यन्याय language. In this chapter, we will see some of the important technical features of this language.

धर्मधर्मिभावः

Every day, we come across a myriad of objects. There are trees, birds, vehicles, buildings, people, and many other things that do not even draw our attention! We are able to tell a tree apart from a bird without much difficulty. In the same fashion, we

effortlessly see the similarities between one tree and another. If you were to classify apple, orange, car and bus into classes, you would no doubt put the apple and the orange in one category, and the car and the bus in another.

When you see two trees, you have no difficulty in identifying them as trees even though you may have never ever come across exactly those same two trees. Yet, Even though the images of the two trees in question were never stored in your brain, a general pattern, was stored, for example, “A large object with many green leaves that gives a cool shade”. When you see an object with this familiar pattern, you conclude that the object must be a tree! Let us call this pattern, the quality that distinguishes a tree from all other objects, as “treeness”. Thus, “treeness” is the quality of being ‘A large object with many green leaves that gives a cool shade’. All trees have this quality, but no other object has it. Of course, this pattern is not the only one, and there can be as many ways of uniquely identifying a tree as the number of leaves on it!

Similarly, what do we look for, in classifying vehicles and fruits? We see that both the apple and the orange have a common quality of “fruitness”, which may be something like “An object with a sweet juicy kernel that tickles the taste buds!” Similarly, both the car and the bus show the quality of “vehicleness”, like “A smelly aluminum box with wheels which transports people from one place to another!” We put the apple and the orange into one category because both have the quality of “fruitness” and the car and the bus into another category because both have the quality of “vehicleness”.

In नव्यन्याय, the technical term for "quality" is **धर्म**, and the object with this quality is the called **धर्मिन्** (usable form: **धर्मी**). So, फलत्वं (fruitness) is the धर्म of apples and oranges, वाहनत्वं (vehicleness) is the धर्म of cars and buses, and वृक्षत्वं (treeness) is the धर्म of trees. Apples, oranges, cars, buses and trees are the धर्मीs, the bearers of the respective धर्मs. A picture is worth a thousand words, so let us summarise what we have said with a picture. Moving on, we will use pictures to construct our sentences extensively.

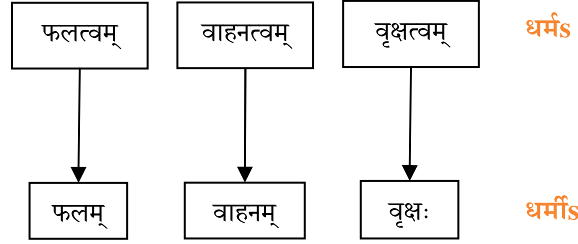


Figure 2.1

In Figure 2.1, the arrows tell us that the धर्मs फलत्वम्, वाहनत्वम्, वृक्षत्वम् reside in the धर्मीs फलम्, वाहनम्, and वृक्षः respectively. The technical term for "residing in" is **निष्ठ** and for the converse, i.e. "containing" is **वत्**. Which one to use depends on what is the focus of the sentence. The following examples will make it clear:

1. **Fruitness** residing in Fruit – फल**निष्ठ**फलत्वम्
2. **Fruit** containing fruitness **–** फलत्व**वत्** फलम्

3. **Treeness** residing in tree – वृक्षनिष्ठवृक्षत्वम्
4. **Tree** containing treeness – वृक्षत्ववान् वृक्षः

(The subject, which is the focus of the sentence, is highlighted in bold above)

This relationship between an object and its quality, or in other words, between the धर्मी and the धर्म is called the **धर्मधर्मिभाव**.

In general, an object that holds another object or a quality is called आधार (base) or आश्रय (refuge). Consequently, the object being held is also called आधेय (that which is "based") or आश्रित (the "refugee"). This terminology is summarized in Figure 2.2. Can you express it in words using our technical terms?

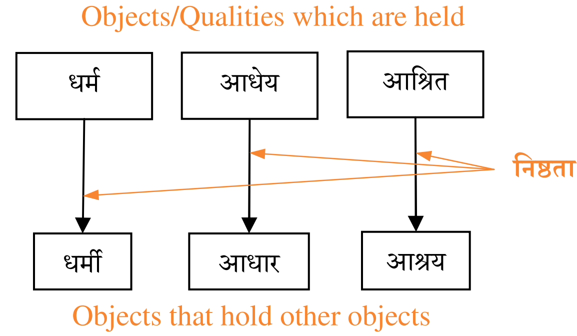


Figure 2.2

Let us now apply the धर्मधर्मिभाव to represent a simple sentence:

भूतले घटः । (There is a pot on the floor).



Figure 2.3

First, notice that the कर्ता (Subject) in the sentence is the pot. (Technically, the exact Sanskrit grammatical term for the English grammatical word 'subject' is अभिहित ('Depending on verb'). Following the popularity of the term, we will continue to use कर्ता. Therefore, our नव्यन्याय representation should ultimately describe the pot. This pot physically resides on the floor. Our most preliminary description of this scene in a diagrammatic way would be something like Figure 2.3

Now as the घट is located on the floor, it is an आधेय. The quality of being an आधेय would be आधेयता. Therefore, the घट has आधेयता, and in our terminology will be called आधेयतावान् घटः । (See Figure 2.4)

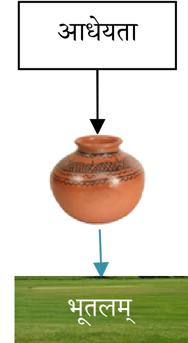


Figure 2.4

Focusing on the two objects (the pot and the floor), both have their respective धर्मs. Let us call the quality of the pot as घटत्वं "potness" and that of the floor as भूतलत्वं ("floorness").

One last relation needs to be added to Figure 2.5 to complete our representation. How did we conclude from the original sentence that the pot is *on* the floor? We deduced it from the fact

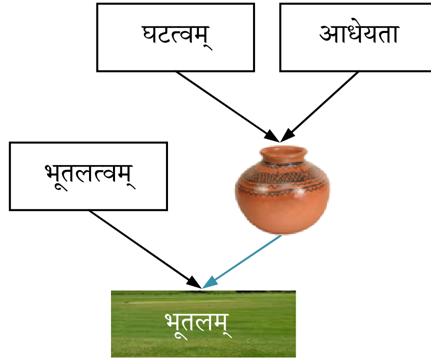


Figure 2.5

that the word भूतल occurs in सप्तमी विभक्ति (locative case). सप्तमी represents the अधिकरण कारक which assigns the role of container to घट. Hence, भूतलं is an अधिकरण and must have the quality of अधिकरणत्वम्.

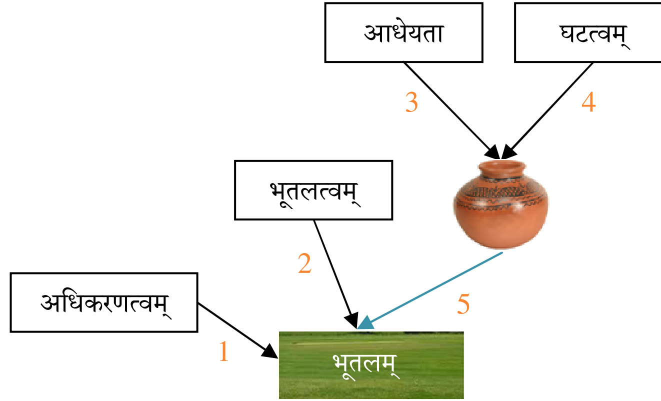


Figure 2.6

We have pictorially represented all the धर्मधर्मिभावs in the original sentence. Let us write them in the नव्यन्याय language (see the corresponding numbers in Figure 2.6):

1. भूतलनिष्ठं अधिकरणत्वम् or अधिकरणत्ववत् भूतलम्
2. भूतलनिष्ठं भूतलत्वम् or भूतलत्ववत् भूतलम्
3. घटनिष्ठा आधेयता or आधेयतावान् घटः
4. घटनिष्ठं घटत्वम् or घटत्ववान् घटः
5. भूतलनिष्ठः घटः or घटवत् भूतलम्

To represent the sentence completely in the नव्यन्याय language, we need to know how to represent the relationship marked 5 in Figure 2.6. But this requires use of another technical feature of the language called निरूप्यनिरूपकभावः, which we will come to in the next section.

For now, we can go on adding as many धर्मs as we wish to any of the धर्मीs. For instance, we could have added आधेयता to भूतलत्वं and अधिकरणत्वं. A word of caution (which is also a spoiler!): We must never over-describe or under-describe the sentence by adding arbitrary धर्मs. We could not have added काठिन्यं (toughness) or नीलवर्णं (blue colour) to घट, because that is not the meaning intended in the original sentence. (The pot in our sentence could very well have been soft and yellow!) Over-description and under-description are called आधिक्य and न्यूनता respectively, and are logical errors. We shall return to them when we see the third technical feature.

निरूप्यनिरूपकभावः *and the* types of धर्मs

One day at the temple, a little boy walked up to a gentleman and said "अहं पुत्रः!" (I am son!). Naturally, the gentleman asked him,

"Whose son?" But he would only tell so much: "I am son!", "I am son!" Being a gentleman, he tried to ignore the child, but eventually, his curiosity got the better of him. Only after searching the entire temple for the child's father, and eventually meeting with him, our gentleman found peace!

Why did the gentleman behave this way? Intuitively, we all know the answer. Technically, we say that the knowledge about the child was **साकांक्ष** (= स + आकांक्षा = provoking further enquiry). Although what he said ("I am son.") was grammatically complete, it provoked further enquiry: "Whose son?" Only upon knowing the father, the knowledge about the child was complete. Instead, had the child said, "I am Rama", there would have been no further curiosity, and our gentleman would have been spared the trouble of finding the father!

In the first case, the धर्म of the child was पुत्रत्वम् (son-ness). It was this peculiar धर्म that provoked further enquiry. Such धर्मs are called साकांक्ष (relative) धर्मs. In the second case, the child's धर्म was रामनामकत्वं (the quality of being named Rama). Such धर्मs are called वास्तव (absolute) धर्मs. (See Figure 2.7).

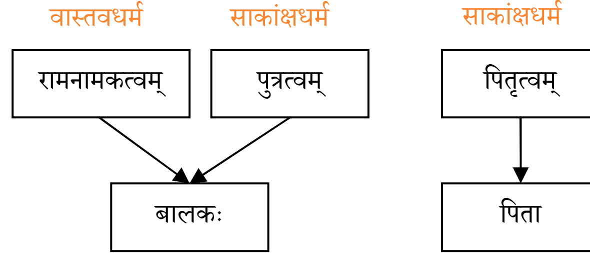


Figure 2.7

Our ultimate aim is to represent knowledge. When knowledge of one object is dependent on the knowledge of another, we need the second object to "describe" the first. Knowledge of the child was obtained from his quality of पुत्रत्वं (*son-ness*), but we also needed the father to describe this quality completely. Such a quality which requires additional description is called **निरूप्य**. The object which describes the निरूप्य is called **निरूपक**. The relationship between the two is called निरूप्यनिरूपकभावः. It is the most ubiquitous feature of the नव्यन्याय language. In our diagrams, we will represent the निरूप्यनिरूपकभावः with an arrow as shown in Figure 2.8.

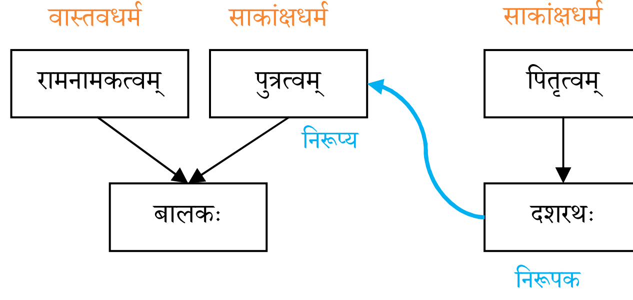


Figure 2.8

We wish to represent the knowledge about the child in our meta-language. Let us do it step by step:

1. The child contains the quality of son-ness. Thus, invoking the धर्मधर्मिभावः, we say: पुत्रत्ववान् बालकः ।
2. The quality of son-ness is described by the father, who happens to be named दशरथः! So we invoke the निरूप्यनिरूपकभावः to say: दशरथनिरूपितं पुत्रत्वम् ।
3. Combining 1 and 2, we have the full description of our child: **दशरथनिरूपितपुत्रत्ववान् बालकः** ।
4. Similarly, the full description of the father will be बालकनिष्ठपुत्रत्वनिरूपकः दशरथः ।

Now notice that just as the knowledge of the child was incomplete without the father, the knowledge of the father is incomplete without the child. The statement "अयं पिता" (This is father) provokes further enquiry "Whose father?" and requires the child Rama, to be specified: "अयं रामस्य पिता" (This is Rama's father). In this case, the निरूप्यनिरूपकभावः will be reversed, and the

correct representation of the father दशरथः will be: **रामनिरूपितपितृत्ववान् दशरथः ।** and that of the child राम is दशरथनिष्ठपितृत्वनिरूपकः रामः । (See Figure 2.9).

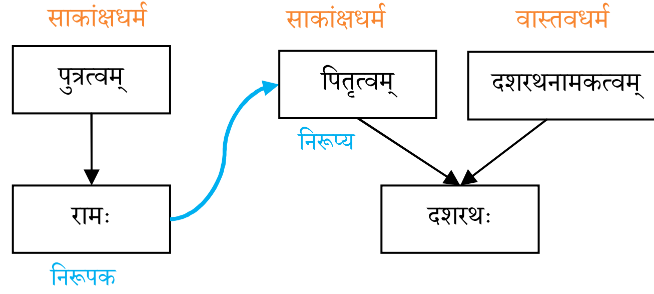


Figure 2.9

It is time to confess that we have cheated! But not quite! So far, we have been using shortcuts to represent the निरूप्यनिरूपकभावः. Strictly speaking, this भाव connects only साकांक्षधर्मs. Compare Figure 2.8 and Figure 2.9 to see how we had to change the निरूप्यनिरूपकभाव arrow artificially, when in reality, it is completely insensitive to direction! Out of the two धर्मs, which one we choose to be the निरूपक and which the निरूप्य should not change our diagrammatic representation. This is achieved by restricting the निरूप्यनिरूपकभाव to साकांक्षधर्मs only.

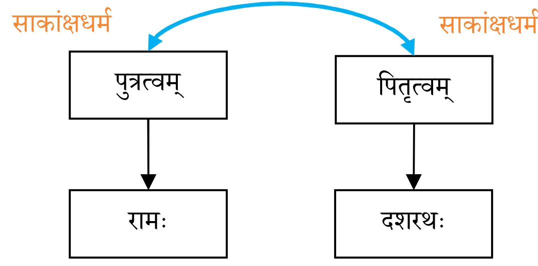


Figure 2.10

Now our भावः has indeed become bidirectional. To describe राम, we may write दशरथनिष्ठपितृत्वनिरूपितपुत्रत्ववान् रामः । and to describe दशरथ, we may write रामनिष्ठपुत्रत्वनिरूपितपितृत्ववान् दशरथः ।

Three Golden rules

Three golden rules summarise the whole concept of निरूप्यनिरूपकभाव we discussed so far:

1. साकांक्षधर्मः साकांक्षधर्माश्रयधर्मिणा निरूपितः एव (न तु धर्मिणः निरूपकः) i.e. साकांक्षधर्म is always described (निरूपित) by the bearer of that धर्म.

2. साकांक्षधर्माश्रयधर्मी तु साकांक्षधर्मस्य निरूपकः एव i.e, the धर्मि containing the साकांक्षधर्म always becomes the describer (निरूपक)
3. साकांक्षधर्मयोस्तु परस्परं निरूप्यनिरूपकभावः i.e. Between two साकांक्षधर्मs, there is निरूप्यनिरूपकभाव.

With this background, we are now ready to complete the representation of भूतले घटः that we began in the previous section. In Figure 2.11, we have just copy-pasted the diagrammatic representation seen earlier (in Figure 2.6), with some additions:

The quality of अधिकरणत्वं (the quality of containing) begs the question "contains what?", and thus is a साकांक्षधर्म. Without specifying the object contained, it would mean, "On the floor, ..."! Incomplete enough to make you pull your hair out, isn't it? Similarly, आधेयता is a साकांक्षधर्म, because without specifying the floor, it would mean, "The pot is on ...."! Between these two साकांक्षधर्मs, we have added the निरूप्यनिरूपकभावः. In words, it would be written as अधिकरणत्वनिरूपिता आधेयता, OR आधेयतानिरूपकं अधिकरणत्वम्।

Now we can easily write the full description of the pot in our language. A general procedure to follow when constructing such representations is as follows: follow the green dotted arrow as in Figure 2.11, starting with भूतलत्वम् and ending in घटः, and go on linking the objects by the relations encountered along the way like this – भूतलत्व-वत्-भूतल-निष्ठ-अधिकरणत्व-निरूपित-आधेयता-वत्-घटः । Also add घटत्व-वत्, which was not encountered along the way.

Finally, join the सन्धिs to get भूतलनिष्ठाधिकरणत्वनिरूपिताधेयतावान् घटत्ववान् घटः ।

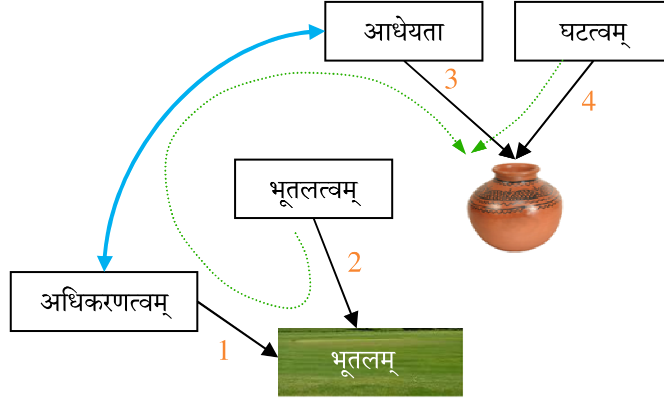


Figure 2.11

As our sentences get more complex, resolving the सन्धिs in the नव्यन्याय representations will become exceedingly cumbersome without a strong background in Sanskrit. For convenience, let us introduce some symbolic notations for our terminology. The following examples will make it clear.

1	निष्ठ	←
2	वत्	→
3	फलनिष्ठफलत्वम्	फल ← फलत्वम्
4	घटनिष्ठाधेयता	घट ← आधेयता
5	आधेयतावान् घटः	आधेयता → घट
6	निरूपित	–»–
7	निरूपक	–«–

8	अधिकरणत्वनिरूपिताधेयता	अधिकरणत्व –»– आधेयता
9	X निरूपकं ज्ञानम्	X –«– ज्ञानम्

Two simple rules to remember this notation are:

1. The → arrow always goes from the आधेय to the आधार. If X resides in Y, then X←Y and Y→X are identical, only the verbal notations change.

2. The –»– arrow always goes from the निरूपक to the निरूपित. Whether it points left or right only changes the words, not the meaning.

Thus, our description of राम would be

((दशरथ ← पितृत्व) –»– पुत्रत्व) → रामः

And the description of घट would be

((भूतल ← अधिकरणत्व) –»– आधेयता) → घटः , and more fully,
(((भूतलत्व → भूतल) ← अधिकरणत्व) –»– आधेयता) → (घटत्व → घटः))

Here is another humorous instance that shows how निरूप्यनिरूपकता helps to resolve unusual communication problems. Once, an elderly teacher asked his half baked Nyaya assistant "दम्पती आनय" (bring a couple). The assistant thought "दम्पती means जाया च पतिश्च (wife and husband)", and brought a lady named L_1 who was the wife of H_1 and a gentleman H_2 who was the husband of

L_2! Furious at his assistant, the elderly teacher used the नव्यन्याय language:

“परस्परनिरूप्यनिरूपकभावापन्नपत्नीत्वपतित्वविशिष्टनिष्ठकर्मतानिरूपक-आनयनकर्ता भव!”

The point is that the पत्नीत्व and पतित्व of $L_1 - H_1$ or $L_2 - H_2$ are mutual निरूप्यनिरूपकs, and not of $L_1 - H_2$ or $L_2 - H_1$!

Now let us move on to the next feature.

अवच्छेद्यावच्छेदकभाव

When I was a kid, I loved to imagine various shapes in clouds. My friends never agreed with the shape that I would suggest, and we would fight over whether a cloud looked more like a duck or a peacock, or like a crocodile or a dragon! My friends and I perceived the clouds differently. But howsoever silly childhood games may be, here, we want to see how we can represent those different perceptions in our technical language.

We are trying essentially to represent the knowledge (cognition) (ज्ञानं) obtained from the perception of the cloud. The cloud is thus an *object of knowledge* or *object of cognition:* ज्ञानस्य **विषयः**. Since knowledge is always *about something*, it always has a विषय, and is therefore called **विषयिन्** (विषयि). Then what are the qualities of ज्ञान and विषय? Simply, the quality of विषय is विषयता (the quality of *being* an object of cognition!) and that of ज्ञान is विषयिता (the quality of *having* an object for cognition). Now the

धर्म विषयिता is साकांक्ष, because saying “knowledge…” provokes the question “of what?” Similarly, विषयता is a साकांक्षधर्म because saying “The cloud is an object of …” demands an answer to “object of what?” Naturally, between the two, there must be निरूप्यनिरूपकभावः. (See Figure 2.14).

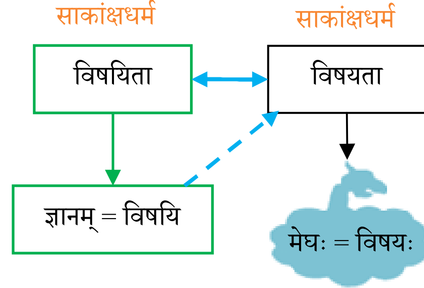


Figure 2.12

Thus, to represent the knowledge obtained, we will write, मेघनिष्ठविषयतानिरूपित-विषयितावत् ज्ञानम् ।

Or in symbols, ((मेघ ← विषयता) –»– विषयिता) → ज्ञानम् ।

Alternatively, we can use our shortcut (dotted arrow) to write मेघनिष्ठविषयतानिरूपकं ज्ञानम् । In symbols, (मेघ ← विषयता) –«– ज्ञानम् ।

Coming back to our childhood game (Figure 2.13), I saw a cloud and said, “अयं मकरः” (This is a crocodile). My friends however, perceived a dragon and said, “अयं वृत्रः”.

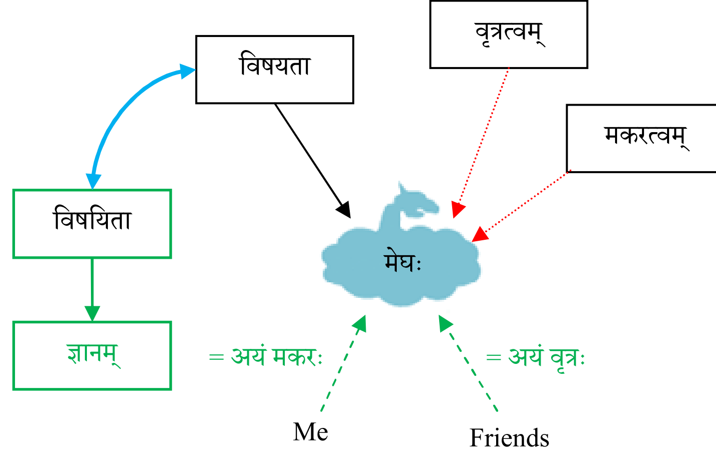


Figure 2.13

A whole world of qualities resides in the विषय. All these qualities **delimit** its विषयता. For example, a cloud may have qualities like श्वेतवर्णत्वम् (*white-coloured-ness*), or जलधारणत्वम् (quality of holding water). When I perceived it as a crocodile, out of all possible qualities, only मकरत्वम् (crocodileness) delimited its विषयता. When my friends perceived it as a dragon, the विषयता was delimited by वृत्रत्वं only, and nothing else. The delimiter is called **अवच्छेदक**. Whatever it delimits is called **अवच्छेद्य**. The relationship between the two is called **अवच्छेद्यावच्छेदकभावः**. The term for "delimited by" is अवच्छिन्न. Thus, "विषयता delimited by मकरत्व" would be written as **मकरत्वावच्छिन्नविषयता**।

For this term, let us use the notation shown below:

1	अवच्छिन्न	{}
2	घटत्वावच्छिन्नाधेयता	घटत्व{आधेयता}
3	मकरत्वावच्छिन्नविषयता	मकरत्व{विषयता}

The cognition (ज्ञानम्) about the cloud will therefore be represented as (differently for my friends and me):

For me: मकरत्वावच्छिन्नविषयतानिरूपकं ज्ञानम् ।
For friends: वृत्वत्वावच्छिन्नविषयतानिरूपकं ज्ञानम् ।

Now strictly speaking, the qualities मकरत्वं and वृत्रत्वं were in reality NOT present in the cloud, but my friends and I were *wrongly* cognizing them (that is why we have shown them with red dotted lines). It was a hallucination, an incorrect cognition, a **भ्रमः**. We will learn to handle various types of cognition in a later chapter.

In our symbolic notation, the sentences we have seen so far would be written as

1. मकरत्व{विषयता} –«– ज्ञानम्
2. वृत्वत्व{विषयता} –«– ज्ञानम्
3. (मकरत्व{विषयता} –»– विषयिता) → ज्ञानम् (full form of 1)
4. (वृत्रत्व{विषयता} –»– विषयिता) → ज्ञानम् (full form of 2)

Now let us look at the sentence: गन्धवती पृथ्वी । (The earth has odour). (Incidentally, this is the definition of the पृथ्वी-महाभूतं, as we will see in the Chapter Five later). This sentence is almost the same as भूतले घटः (पृथ्वी is equivalent to भूतलं, and on it, instead

of a pot we have odour). The only difference is that in भूतले घटः, the Subject is घट, while here, it is पृथ्वी. The diagrammatic representation shown in Figure 2.14 is identical to भूतले घटः.

Now the sentence speaks only of गन्धः as a quality of पृथ्वी, distinguished from many other qualities like hardness, colour, etc. In other words, the whole universe of आधेयता is delimited by the property that picks out गन्धः, namely, गन्धत्वं. Thus, गन्धत्वं becomes an अवच्छेदक for आधेयता. We will show it in our diagrams by a red arrow with a curly bracket.

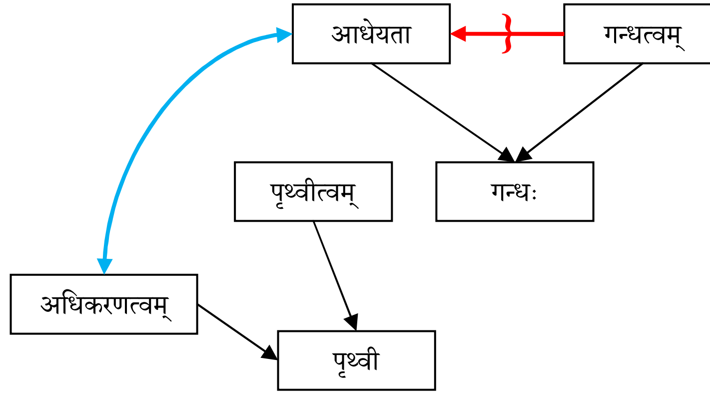


Figure 2.14

Our नव्यन्याय representation would read गन्धत्वावच्छिन्नाधेयतानिरूपिताधिकरणतावती पृथ्वी।

In symbols, (गन्धत्व{आधेयता} –»– अधिकरणता) → पृथ्वी.

So far, we have encountered sentences that were describing an existing object. But what if we want to speak about the absence of something? In our भूतले घटः example, the verb अस्ति was implicit. How to represent घटः नास्ति? The quality of **not** residing is called **प्रतियोगिता**, the opposite of आधेयता. The word for absence is **अभावः**.

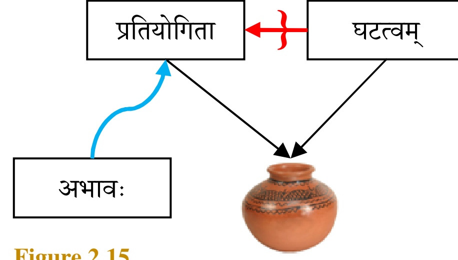


Figure 2.15

The diagram for घटः नास्ति । is shown in Figure 2.15. It is easy to construct the नव्यन्याय representation: घटत्वावच्छिन्न-**प्रतियोगिता**निरूपकः अभावः । Symbolically: घटत्व{प्रतियोगिता} –«– अभावः ।

One interesting observation evolves from these examples: It is *only* वास्तवधर्मs that become अवच्छेदकs. साकांक्षधर्मs cannot. We say घटत्वाच्छिन्नप्रतियोगिता not प्रतियोत्वावच्छिन्नघटत्व, because, घटत्व is, by nature, already delimited.

Two types of अवच्छेदकs

In the two examples we saw earlier (one of the cloud and the other of गन्धवती पृथ्वी), the अवच्छेदकs were of a fundamentally different nature. In the first case, the अवच्छेदक was a mode of cognition, and in the second case, it conveyed अन्यून-अनतिरिक्तवृत्ति.

अवच्छेदक is often used in these two varied contexts, so we classify it into two types.

1. **अवच्छेदक as mode of cognition**: This is called स्वरूपसम्बन्धरूपम् अवच्छेदकत्वम्. When we say मकरत्वावच्छिन्नविषयतानिरूपकं ज्ञानम्, what we mean is, 'the mode of the cognition of the subject is मकरत्व'.
2. **अवच्छेदक conveying अन्यून-अनतिरिक्तवृत्ति 'located neither less nor more'**: The अवच्छेदक should be अन्यून-अनतिरिक्तवृत्ति to अवच्छेद्य. When we spoke of the absence of घट, the घटत्व alone becomes अवच्छेदक. If something more general is made the अवच्छेदक, like material-ness, it would imply absence of all materials, not only that which makes up the pot. Nor could we have made the अवच्छेदक any more specific, like नीलघटत्व (blue-pot-ness), because that would not exclude the existence of yellow pots, contary to the original intention.

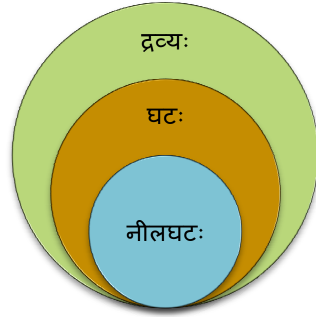


Figure 2.16

Why do we need *अवच्छेदक* at all?

One question that may have bugged you since the start of this section would be this: Why do we need अवच्छेदकs at all? Why

can’t we simply do away with them? After all, why not simply say मकरत्ववान् मेघः, or गन्धनिष्ठाधेयतानिरूपिताधिकरणवती पृथ्वी?

The simple answer is: To resolve contradiction. Let us illustrate by example. In many bollywood movies, the hero is portrayed as a duty-bound policeman, who comes to arrest his criminal father, and in a dramatically sentimental scene, says, “Father! Today I am not here as your son, but as a police inspector! I must arrest you for your crimes!”

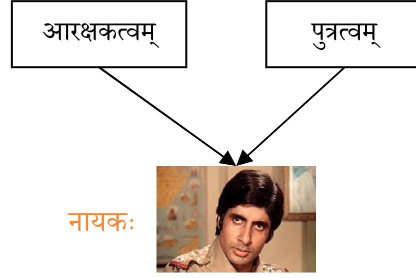


Figure 2.17

Our hero (नायक) has the qualities of पुत्रत्वं (son-ness) and आरक्षकत्वं (policeman-ness). Now if we use निष्ठा to represent him, we will have to say: पुत्रत्ववान् नायकः नास्मि । आरक्षकत्ववान् नायकः अस्मि । Now here is the contradiction: नायकः नास्मि – नायकः अस्मि! (I am hero – I am not hero) Obviously, these two self-contradictory statements cannot be simultaneously true. Such a contradiction is called **प्रतिबध्यप्रतिबन्धकभावः**. Once we say “नायकः अस्मि”, it logically follows that “नायकः नास्मि” cannot be true. Thus, अस्मि restricts the existence of नास्मि, or technically, becomes a **प्रतिबन्धक** for नास्मि.

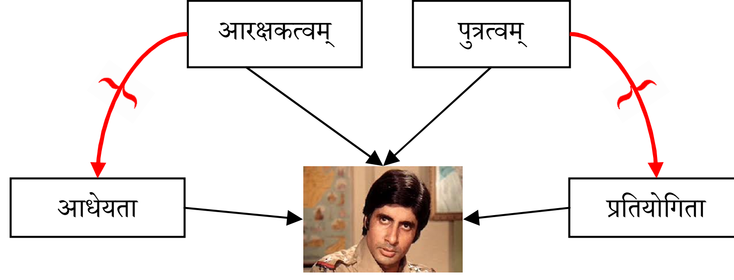


Figure 2.18

Now see Figure 2.18. The representation of this diagram is

आरक्षकत्वावच्छिन्नाधेयतावान् पुत्रत्वावच्छिन्नप्रतियोगितावान् नायकः।

Or [आरक्षत्व{आधेयता}→][पुत्रत्व{प्रतियोगिता}→] नायकः।

We have introduced आधेयता and प्रतियोगिता, both of which reside in the hero. Now these two qualities are mutually contradictory, so they would normally cancel each other. However, because of the use of अवच्छेद्यावच्छेदकभावः, we have picked up the only that portion from the universe of आधेयता that is delimited by policeman-ness. Similarly, from the whole universe of प्रतियोगिता, we have picked out only that portion which is delimited by son-ness. These two portions, being different, do not cancel, and can co-exist in the same object. In general, the प्रतिबन्ध्यप्रतिबन्धकभावः applies only when the mutually contradictory धर्मs are delimited by the same अवच्छेदक.

Some Other types of *अवच्छेदकs*

So far, we have seen only धर्मs as अवच्छेदकs. Time and space can also become अवच्छेदकs. Recall that the core meaning of अवच्छेदक is delimiter. In that sense, it is not difficult to understand this point. Consider this example:

शिवाजीराज्यकाले सुभिक्षम् आसीत् । (*There was bountiful during the reign of king Shivaji.)* Here the आधेयता of सुभिक्ष is delimited by a particular time: That of the King's reign.

In the sentence वृक्षे शाखायां कपिः उपविष्टः । (*The monkey is sitting on a branch of a tree)*, वृक्षनिरूपित-कपिनिष्ठाधेयता is delimited by शाखा. Thus space has become the अवच्छेदक.

अवच्छेदक can also be used as a shortcut. There is a rule: अवच्छेदककोटिप्रविष्टानाम् अपि अवच्छेदकत्वम् (the part of a delimiter is also a delimiter). Consider this example:

सर्पज्ञानं भयजनकम् (Cognition of snake generates fear).

We now include the नव्यन्याय vocabulary step by step:

→ सर्पविषयकज्ञानं भयजनकम्

→ सर्पत्वनिष्ठप्रकारतानिरूपकज्ञानं भयजनकम्[1]

---

[1] If one mistakes a snake for something else, he/she does not get fear. But even if one mistakes something harmless as snake, he/she gets fear. Thus, सर्पत्वनिष्ठप्रकारतानिरूपकज्ञानं भयजनकम् is correct, but सर्पनिष्ठविशेष्यतानिरूपकज्ञानं भयजनकम् is wrong.

→ सर्पत्वनिष्ठप्रकारतानिरूपकज्ञाननिष्ठा भयजनकता
→ सर्पत्वनिष्ठप्रकारतानिरूपकज्ञानत्वं भयजनकतावच्छेदकम्

We can cut the long sentence short with the अवच्छेदक to simply say "भयजनकता सर्पत्वावच्छिन्ना"!

We will see later that even relations between objects can become अवच्छेदकs. Here are two advanced examples of usage of धर्मावच्छेदक and संबन्धावच्छेदक. Beginners may skip to the next section.

१. साध्यतावच्छेदकधर्मावच्छिन्न- साध्यतावच्छेदकसम्बन्धावच्छिन्न-प्रतियोगिताकः अभावः । This is the expansion of साध्याभावः normally found in any text dealing with व्याप्ति.
२. व्याप्यतावच्छेदकप्रकारकपक्षधर्मताज्ञानत्वम् उभयमतसिद्धनियतपूर्ववृत्तितावच्छेदकम् । (Di.289)

विशेषणविशेष्यभावः

Using the momentum built so far, let us take another example, which is at slight variance with the previous one. Consider the sentence सुन्दरं पुष्पम् । (A beautiful flower). What are the qualities of the flower? One quality is of course, पुष्पत्वम् (flowerness), which serves to distinguish it from other objects. But this sentence talks specifically about a beautiful flower, distinct from an ugly one! So we should add another quality of beauty, (सौन्दर्यम्). The visual representation would look like Figure 2.19.

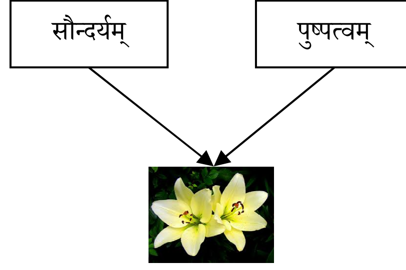


Figure 2.19

We may be tempted to represent it as सौन्दर्य{पुष्पत्व}→पुष्पम्. But we cannot do so, because पुष्पत्वम् is not a साकांक्षधर्म, and अवच्छेदकs can only delimit साकांक्षधर्मs. सौन्दर्यं and पुष्पत्वं are called **समानाधिकरणs**, i.e. those which reside in the same entity, in this case, the flower.

For the correct representation of this sentence, we should use the fourth feature of नव्यन्याय language: **विशेषणविशेष्यभावः** । What is a विशेषण? विशिष्यते व्यावर्त्यते अनेन इति विशेषणम् । So विशेषण is also a delimiter (**व्यावर्तक**), which picks out a special quality from the delimited object (In our case, beauty).

The correct representation for sentences of this kind is done using the term “**विशिष्ट**” like this: सौन्दर्यविशिष्टं पुष्पम्।

Quantifiers in नव्यन्याय

We have seen several technical features of the नव्यन्याय language. In this section, we will see an example of how we can use these features in novel ways, i.e. in ways that are not found in traditional texts. Western logicians can distinguish between the following four sentences:

1. A student wants a teacher.
2. A student wants all teachers.
3. All students want a teacher.
4. All students want all teachers.

“A” and “all” are quantifiers. Can we represent these sentences in नव्यन्याय? The answer is yes. Let us see how. The first sentence can be represented as the shown in Figure 2.20.

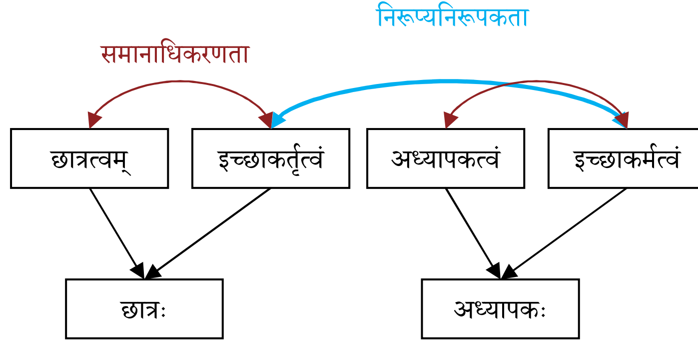


Figure 2.20

Both छात्रत्वम् and इच्छाकर्तृत्वम् (quality of being the subject of wanting) reside in छात्रः. They are therefore, called **समानाधिकरण**s (those with same location). छात्रत्वं is obviously a वास्तवधर्म. Since इच्छाकर्तृत्वं demands the answer to the question "wants what?" it is a साकांक्षधर्म, and the answer to this question is the इच्छाकर्मत्वं (quality of being the object of wanting) and resides in the अध्यापक (teacher). So the representation would be

छात्रत्वसमानाधिकरणेच्छाकर्तृत्वनिरूपितेच्छाकर्मत्वसमानाधिकरणाध्यापकत्ववान् अध्यापकः।

(छात्रत्व ~ इच्छाकर्तृत्व) —»— (इच्छाकर्मत्व ~ अध्यापकत्व) ⟶ अध्यापकः।

We shall need some new symbols:

1	समानाधिकरण	~
2	छात्रत्वसमानाधिकरणेच्छाकर्तृत्व	छात्रत्व ~ इच्छाकर्तृत्व

3	इच्छाकर्मत्वसमानाधिकरणाध्यापकत्व	इच्छाकर्मत्व ~ अध्यापकत्व
4	व्याप्य	<>
5	छात्रत्वव्यापकेच्छाकर्तृत्व	<छात्रत्व> इच्छाकर्तृत्व
6	इच्छाकर्तृत्वव्याप्यछात्रत्व	इच्छाकर्तृत्व <छात्रत्व>

The third sentence is slightly different. It will be represented as

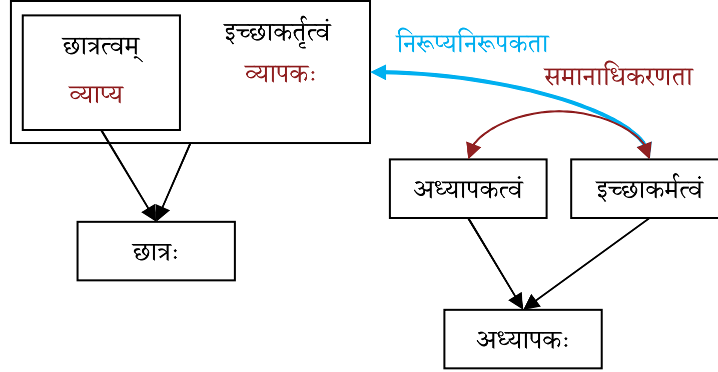


Figure 2.21

In this case, wherever there is छात्रत्वम्, there is इच्छाकर्तृत्वम्. The इच्छाकर्तृत्वम् pervades all छात्रs, and is called **व्यापक**. The छात्रत्वम् is the व्याप्य. Using this terminology, we can represent it as

छात्रत्वव्यापकेच्छाकर्तृत्वनिरूपितेच्छाकर्मत्वसमानाधिकरणाध्यापकत्ववान् अध्यापकः ।

Or in symbols,

(<छात्रत्व>इच्छाकर्तृत्व —»— इच्छाकर्मत्व ~ अध्यापकत्व) → अध्यापकः ।

Cases 2 and 4 can be represented similarly, with the व्यापक and समानाधिकरणs appearing at the appropriate places:

Case 2: (छात्रत्व ~ इच्छाकर्तृत्व —»— इच्छाकर्मत्व <अध्यापकत्व>) → अध्यापकः ।

Case 4: (<छात्रत्व> इच्छाकर्तृत्व —»— इच्छाकर्मत्व <अध्यापकत्व>) → अध्यापकः ।

A more standard example of the use of the word "सर्व" is – सर्वे घटाः रूपवन्तः । which implies घटत्वव्यापकं रूपम्. (Di. 380)

These are the important features of the नव्ययाय language. We will use them again and again throughout this book. In the next chapter, we will explore different kinds of relations that may exist among entities.

Never argue with a नैयायिक! Suppose you see that there is a book on the table, and you say, "उत्पीठिकायां पुस्तकम् अस्ति" (There is a book on the table). The नैयायिक will say, "No! The book is not on the table!" Alarmed, you would ask him, "Are you blind?" Immediately, he will reply in a cool tone, "समवायेन नास्ति!! (It is not on the table by the relation of inherence!)"

Cognition is impossible without relations. But what is a relation? The simplest practical definition is "विशिष्टबुद्धिजनकत्वं संबन्धलक्षणम्". This means, "That which generates a विशिष्ट i.e. 'connected' cognition is called a relation". In regular usages like "विशिष्टपुरुषः", the word विशिष्ट means peculiar or special. In our case this word is used in a different sense. It emphasizes the relational sense like in the usage "दण्डविशिष्टः पुरुषः" (a man with stick).

Cognitions arising because of relations tell us something more than those arising from the unrelated objects alone. For example, when we see a cat with a dead rat dangling from its mouth, it tells us a lot more than seeing either the cat or the rat alone! But how do we judge if the cognition is special? The answer lies in expression. If, while expressing the cognition, we are forced to use विभक्तिs, then we conclude that the cognition is special. For example, when we see the cat with a rat in its mouth, we don't express it as "मार्जार मुख मूषक"! We say "मार्जारस्य मुखे मूषकः". We had to use the षष्ठी, सप्तमी and प्रथमा विभक्तिs. These

विभक्तिs convey the relations. Thus, the rat was related to the cat's mouth. The mouth is of course, always related to the cat.

Someone objects, "what if there is no relation with anything. Let's say, I was seeing fire in an empty space. Then there is cognition of fire, but there is no relation with anything else." The answer is that even when we see fire in empty space, we really cognize it only because of its quality of fireness, and this quality is related to the fire itself. Indeed, it is this relation between the fire and the fireness that causes the cognition of fire.

Relations are of several types. Some important ones are: संयोग, समवाय, पर्याप्तिः, कालिकसंबन्धः, देशिकसंबन्धः and परम्परासंबन्धः.

संयोग

संयोग is a temporary physical contact between two objects (More specifically, two द्रव्यs. We will meet द्रव्यs in Chapter Five). The भाषापरिच्छेद defines it as

अप्राप्तयोस्तु या प्राप्तिः सैव संयोग ईरितः ॥ ११५ ॥

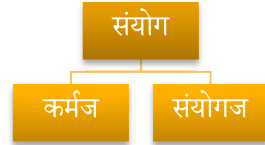


Figure 3.1

When two objects which were not in contact are brought into contact, that contact itself is संयोग.

संयोग is possible only between two द्रव्यs. अन्नम्भट्ट classifies it into two categories:

that which arises from कर्म (कर्मज) and that which arises from contact (संयोगज). If you stretch your hand and touch a wall, the संयोग between the wall and your hand is कर्मज, resulting from your action of moving the hand. But the संयोग between your body and the wall arises because of the contact between the hand and the wall, and thus is संयोगज.

Two objects in contact are called संयोगी objects and संयोग resides in both of them.

Let us consider the sentence: "शाखायां खगः", (The bird is on the branch). Here, the संयोग resides in the bird as well as the branch. It is included in our नव्यन्याय representations as shown in Figure 3.2.

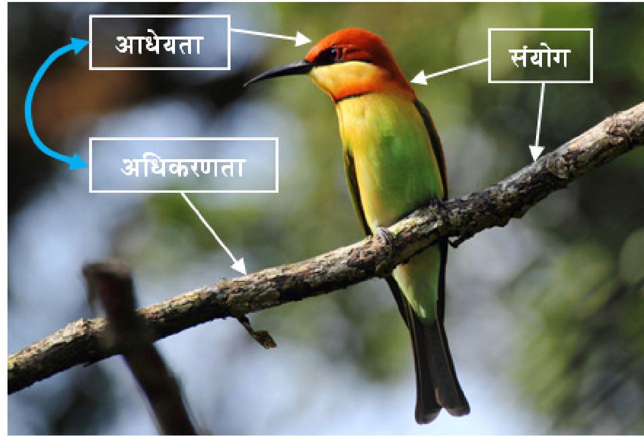


Figure 3.2 (photo courtesy: Ashok Kumar Malik, CES, IISc.)

A rather informal representation of the संबन्ध can be written as संयोगेन शाखानिष्ठाधिकरणतानिरूपिताधेयतावान् खगः । We shall return to see a more technical representation of the संबन्धs towards the end of this chapter.

समवाय

समवाय is a permanent, intimate, and inherent relation. When संयोगी objects are separated, the संयोग is destroyed. But not so with समवाय – it cannot be destroyed until the objects themselves are destroyed. For example, blue colour resides in a blue cloth. The cloth and its colour can never exist independent of each other. Only when the cloth is destroyed, the blue colour also gets destroyed, and consequently, the relation is also destroyed. This relation between the cloth and its colour is समवाय. One clarification is, though we feel that समवाय is destroyed when the समवायिs are destroyed, न्याय school accepts समवाय as one and only one & eternal. However it is mentioned as an opinion of a few authors that it is many and perishable, just like संयोग.

The definition of समवाय is "अयुतसिद्धयोर□समवायः". युत here means unmixed, so अयुत means not unmixed i.e. mixed only. Thus समवाय exists only between entities that are mixed together.

समवाय exists between five kinds of pairs of entities:

1. Between गुण and गुणी – Examples include cloth and its colour, steel and thoughness, संयोग and संयोगीs, etc.

2. Between अवयव and अवयवी – Examples include gold and its atoms, water and hydrogen atom, body and hand, etc.
3. Between क्रिया and क्रियावत् – An example would be a runner and action of running.
4. Between सामान्य and its आश्रय – Examples are pot and potness, cloth and clothness etc.
5. Between विशेष and परमाणुs – विशेष will be discussed in Chapter Five. The relation between these two is also समवाय.

Informally, let us see how to represent the समवाय in: घटरूपम्।

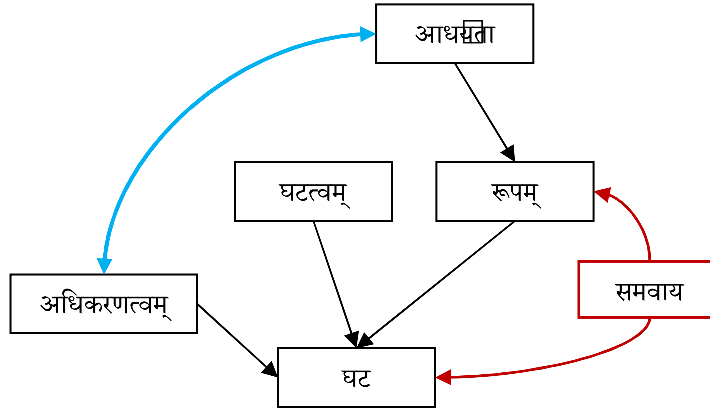


Figure 3.3

Following Figure 3.3, we can easily represent the घट as रूपनिष्ठाधेयतानिरूपिताधिकरणत्ववान् घटः।

Since the रूप resides in the घट by समवाय, we add समवायेन like this – समवायेन रूपनिष्ठाधेयतानिरूपिताधिकरणतावान् घटः ।

पर्याप्तिः

Sometimes, instead of a one-one relation, a one-many relation is needed. That relation is पर्याप्ति. For example one of the qualities listed by the वैशेषिकs is संख्या (number). It has समवाय as relation with each subject. But that is not sufficient. For example, consider the sentence पञ्च हस्तिनः । (five elephants).

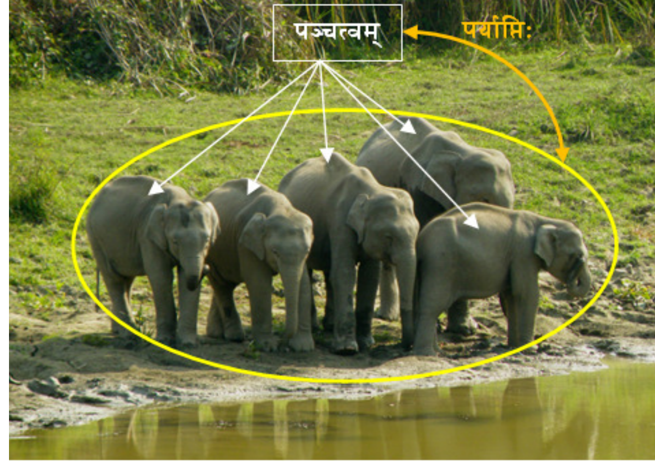


Figure 3.4 – Photo courtesy: Karpagam Chelliah, CES, IISc

By virtue of being in a group of five, each of the five elephants has the quality of पञ्चत्वम् (five-ness). This quality resides in each

of the elephants by समवाय. But, by picking one of them, we can't say अयं पञ्च (this is five). So we need a separate relation between the whole group and the quality of पञ्चत्वम्. That is पर्याप्तिः. It is considered as a great contribution of न्याय in the field of reasoning. It gives more strength to handle qualities functioning with groups. Qualities like पञ्चत्व and घटत्व reside in many objects. But there is a difference between the two. घट means only one घटत्वाश्रय not all घटत्वाश्रयs. On the other hand, पञ्च implies all पञ्चत्वाश्रयs. Even if we see one elephant, we can say "there are no five elephants". But this is not possible in the case of घटत्व. The reason for this is पर्याप्ति.

वनत्व, स[illegible]त्व are some other common qualities reside in their locations through पर्याप्ति.

The अवच्छेदकता also gets related through पर्याप्ति. When we say `there is no big pot', the प्रतियोगितावच्छेदकs here are not `only bigness' or `only potness', but both. That means अवच्छेदकता is functioning with many locations. So अवच्छेदकता has पर्याप्ति with bigness and potness.

We conclude this section with a standard Shastric example, without much explanation: महानसीयवह्निः नास्ति इत्यस्य महानसीयत्व-वह्नित्व-उभयपर्याप्त-अवच्छेदकतानिरूपित-वह्निनिष्ठप्रतियोगिता-निरूपकः अभावः इत्यर्थः ।स्वरूपम्

In the previous section, we saw that संयोग resides in the objects that it connects by समवाय. But by what relation does the समवाय reside in those objects? If we say by समवाय again, then the same question will arise: by what relation does *that* समवाय reside in the object, and thus we will end up in an infinite recursion. (Figure 3.5) To resolve this problem, the नैयायिकs have introduced a new relation called स्वरूप, which means identity. They say that समवाय resides in the समवायी object by स्वरूपसंबन्ध, or in other words, is identical with it.

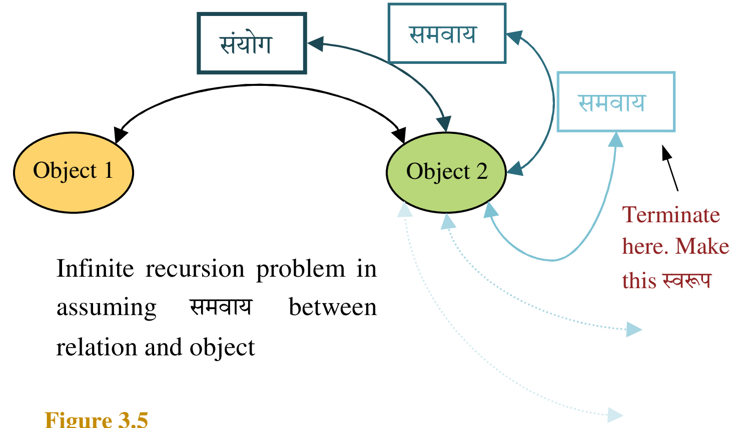


Figure 3.5

In "सुन्दरं पुष्पम् ।", सौन्दर्य is not a द्रव्य and therefore, cannot reside in in the flower by संयोग. It is neither गुण, nor अवयव, nor क्रिया, nor सामान्य, nor विशष□ So it cannot reside in the flower by समवाय. In such cases also, we say that it is related to the flower by स्वरूप.

In Nyaya, all other relations that are neither संयोग nor समवाय are clubbed into स्वरूप. स्वं = one's own रूपं = form. Thus स्वरूप means Identity. That is why the word स्वरूपसम्बन्ध it explained as स्वरूपम□ सम्बन्धः – one's own identity is the संबन्ध. The relations presented in next sections are types of स्वरूप.

कालिकसंबन्धः

Consider the example "ह्यः प्रदर्शनम् अवर्तत ।" (Yesterday, there was an exhibition.) Can we say that the exhibition is related to time by संयोग? We could, but that does not give us any information. Since time is eternal and all-pervading, it is always related to everything else by संयोग. Therefore, when we want to refer specific objects in relation to time, we say that the two are connected by कालिकसंबन्धः.

परम्परासंबन्धः

So far, all संबन्धs that we saw were such that the objects involved were in direct contact. But objects not in direct contact can also be related. Suppose you see a bird sitting on a tree branch. On the opposite branch, you see a monkey. Both the monkey and the bird are related to the tree by संयोग. The sight of the monkey and the bird sitting thus creates विशिष्टबुद्धि, so they must be related. But the relation can neither be contact, nor समवाय. It is a complex relation which arises because both are in contact with a third object, the tree. Such complex relations are called

परम्परासंबन्धs. In present example it is समानाधिकरणत्व i.e. एकाधिकरणवृत्तित्व meaning “being on same location”.

In न्याय texts we come across many long interesting परम्परासम्बन्धs.

1. स्वजनकविघ्नध्वंसोत्पत्त्यवच्छेदकता (Di. 12),
2. साध्यतावच्छेदकसम्बन्धावच्छिन्नप्रतियोगितावच्छेदकता (Ra.ru. 298),
3. स्वनिरूपकनिरूपितत्वम्, स्वावच्छेदकक्षणावच्छिन्नत्वम् (Sha.bo. 30)

विषयताप्रभेदाः

Earlier, we promised that we would see a formal technique to include relations in our नव्यन्याय representations. The time has now come to do so. We have seen that cognition always has an object (विषय). The quality of this विषय is विषयता. The object of cognition is the विषयि, and therefore it has the quality of विषयिता.

Now विषयता can be divided into three categories:

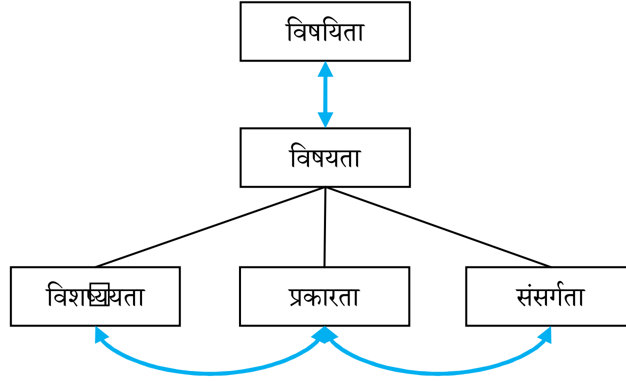


Figure 3.6

1. विशेष्यता – This is the quality that resides in the actual object about which the cognition happens, like pot, bird, etc. How to identify such an object? Simply look at its विभक्ति. The object in the प्रथमा विभक्ति is the विशेष्य.
2. विशेषणता or प्रकारता – This is the quality that modifies the विशेष्य. It serves to distinguish the object of cognition from all others that are not part of the current cognitive event.
3. संसर्गता – This resides in the relations that are involved in the cognition.

There is निरूप्यनिरूपकभावः between the different types of विषयता.

Suppose you are looking at a tree. The tree itself is the विशेष्य and has विशेष्यता. It contains tree-ness, the common quality of all trees, which is a प्रकार or विशेषण and thus contains प्रकारता. The

tree-ness resides in the tree by समवाय relation. The relation contains संसर्गता. See Figure 3.7.

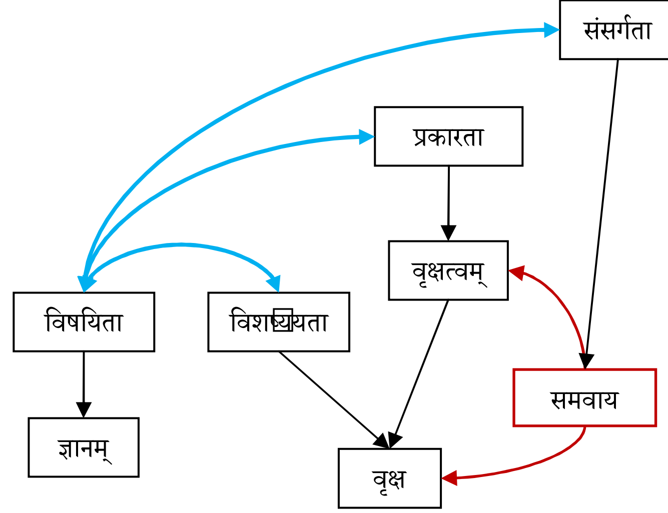


Figure 3.7

To represent the tree fully in our language, just link all the different विषयताs to the विषयिता as follows:

वृक्षनिष्ठविशेष्यतानिरूपितवृक्षत्वनिरूपितप्रकारतानिरूपितसमवायनिष्ठसंसर्गतानिरूपित-विषयितावत् ज्ञानम् ।

In symbols,

([(वृक्ष←विशेष्यता) –»–][(वृक्षत्व←प्रकारता) –»–][(समवाय←संसर्गता) –»–] विषयिता) ⟶ ज्ञानम्।

In school, our geography teacher used to take us out in the field and show us exciting things. Once, she took us bird watching in the forest. Pointing to a jet black bird with bright red eyes, she said “अयं पिकः” (This is a cuckoo).

What happens in this scene is that the teacher, having pointed out the bird (**उद्दिश्य**), declares that (**विधीयते**) it is a cuckoo. Therefore, the bird becomes the **उद्देश्य** of the action of pointing out, and the पिकत्वम् (cuckoo-ness) which resides in the bird, which distinguishes it from all other birds, becomes the **विधेय**. We had seen that very bird hundreds of times before, but did not know that it was a cuckoo. In other words, उद्देश्य is that which is previously known; and विधेय is that which is previously unknown, but is being made known currently. This is called **उद्देश्यविधेयभावः**. This provides another classification of विषयता into two types: उद्देश्यता and विधेयता. This classification is especially useful in the cognition of speech.

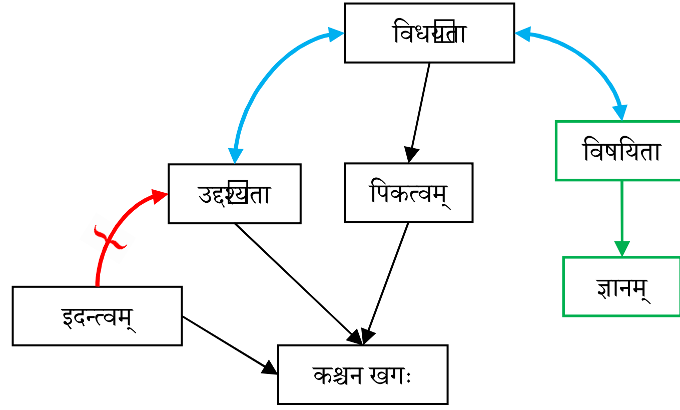


Figure 3.8

The cognition obtained from the teacher's speech is shown in Figure 3.8. We saw some unknown bird, so we represent it by just that: कश्चन खगः । It still contains पिकत्वम्, which was pointed out to us by the teacher by the word अयं.

Following the Figure 3.8, we can represent this sentence as इदन्त्वावच्छिन्नखगनिष्ठोद्देश्यतानिरूपितपिकत्वनिष्ठविधेयतानिरूपकं ज्ञानम् ।

In symbols, (इदन्त्व{खग←–उद्देश्यता}–»– (पिक←–विधेयता)) –«–ज्ञानम् ।

संबन्ध *as* अवच्छेदक

When we introduced अवच्छेद्यावच्छेदकभाव in Chapter Two, we only saw धर्मs as अवच्छेदकs. But संबन्धs can become अवच्छेदकs no less. Remember the नैयायिक whom we met in the opening of this

chapter? He said the book is not on the table by समवाय. Now he is back, and he says, “The book is on the table by संयोग”. You contradict: “पुस्तकम् अस्ति – पुस्तकम् नास्ति । That is a contradiction!” He clarifies, “use the संबन्धs as अच्छेदकs like this.”

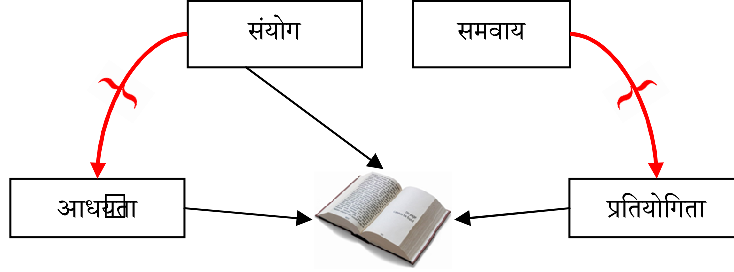


Figure 3.9

संयोगावच्छिन्नाधेयतावत् समवायावच्छिन्नप्रतियोगितावत् पुस्तकम् ।

We have now covered most of the technical vocabulary (पारिभाषिकपदs) of नव्यन्याय. Once you gain familiarity with these words, you can easily comprehend all complex setences from various शास्त्रs. For example, try to grasp these definitions of काव्य from अलङ्कारशास्त्र (asthetics), given by जगन्नाथ (16th AD) in his रसगङ्गाधरः.

1. यत्प्रतिपादितार्थविषयकभावनात्वं चमत्कारजनकतावच्छेदकत्वं तत्त्वं काव्यत्वम्
2. स्वविशिष्टजनकतावच्छेदकार्थप्रतिपादकतासंसर्गेण चमत्कारत्ववत्वं काव्यत्वम्

Of course, you should also have some background about the meanings of the words चमत्कार, भावना and their cause and effect relations, to understand precisely what the author means. Note that the second definition uses the shortcut of अवच्छेदक, which we saw in Chapter Two.

Chapter Four : शाब्दबोधः – A computational perspective

> *Rani Lakshmibai of Jhansi was a fearless, heroic warrior. She did not surrender her kingdom. She single handedly fought the entire British army. She played a key role in the war for independence in 1857.*

When we read this paragraph, it is immediately clear to us that this paragraph wants to convey information about Rani Lakshmibai, and not about the war for independence or about the year 1857! We even sense that it is not merely telling us *about* Rani Lakshmibai, but by giving her example, actually teaching *us* to be brave and fight for what is right. How would a computer analyze this sentence and "understand" the meanings intended?

Armed with the language of नव्यन्याय, we will now begin to answer this question. The first step of course, is to *parse* the sentence, i.e. create a representation of all the objects and relationships in it in a way that a computer can understand. We have already had a glimpse of the नव्यन्याय representations in Chapter Two. Unfortunately, the full details as to how parsing and relationship extraction are carried out in practice today are highly specialized topics in natural language processing, which are beyond this text. Here, we want to see how नव्यन्याय concepts can be used for these tasks, so we will worry little about the conventional techniques.

Let us start once again, with a simple sentence:

कपिः हस्तेन फलं खादति। (The monkey eats a fruit with its hand.)

To interpret this sentence, we should ask ourselves four questions:

1. What are the various objects/words (पदs) in this sentence and their meanings?
2. What are their roles?
3. What are the relationships between various meanings?
4. What is the import (intended meaning) of the sentence?

Each word is made of two parts: the root and the suffix. The root identifies the object and the suffix determines the **कारक**, which in turn determines what role the root object plays in the sentence. First, we want to identify all the **पद**s in the sentence. According to grammarians, पद is any word which ends in सुप् or तिङ् (सुप्तिङन्तं पदम् ।). So according to grammarians, the पदs in the above sentence are कपिः, हस्तेन, फलं, and खादति. In this scheme, the पदs are not the same as the objects they represent: the object names are कपि, हस्त, फल, and खादनक्रिया. Only upon adding suffixes to the object names, do we get the actual words used in the sentence. In the न्याय scheme, the definition of पद is "शक्तं पदम्" (meaningful is word), so the suffixes are also treated as separate पदs. The पदs in न्याय are therefore, कपि, सु, हस्त, टा, फल, अम्, खादनक्रिया, and ति (see Table 4.1 for details), and therefore represent the actual objects as well as the relations between them.

Next, we assign the roles to each object.

1. The first word कपिः is formed by the grammatical process as follows: कपि + सु → कपि + स् → कपिस् → कपिः । The suffix सु stands for the प्रथमा विभक्तिः, and assigns the role of कर्ता (subject) to the root object. Thus, कपि becomes the subject, and has the quality of कर्तृत्वम्.
2. The word हस्तेन is formed as follows: हस्त + टा → हस्त + इन → हस्तेन. The suffix टा, which gets converted to इन, stands for the तृतिया विभक्तिः and assigns the role of करण (instrument) to the root object. Thus, हस्त is an instrument and has the quality of करणत्वम्.
3. The word फलं is formed as follows: फल + अम् → फलम्. The suffix अम् stands for the द्वितिया विभक्तिः and assigns the role of कर्म to the root object. Thus, फल becomes the कर्म and has the quality कर्मत्वम्.
4. Finally, the word खादति is formed as follows: खाद् + अ + ति → खादति. The suffix ति tells us that the action is being performed by a singular कर्ता in the third person and in the present tense. (The अ does not add any meaning. Its role is just to indicate which group the root belongs to.)

The पद्s, roles/meanings (**अर्थाः**), relations (**संसर्गाः/संबन्धाः**) and interim-knowledge (**खण्डबोधाः**) are summarized in Table 4.1.

The next step is to set up the relationships between the पद्s. Figure 4.1 shows the धर्मधर्मिभावः for each पद.

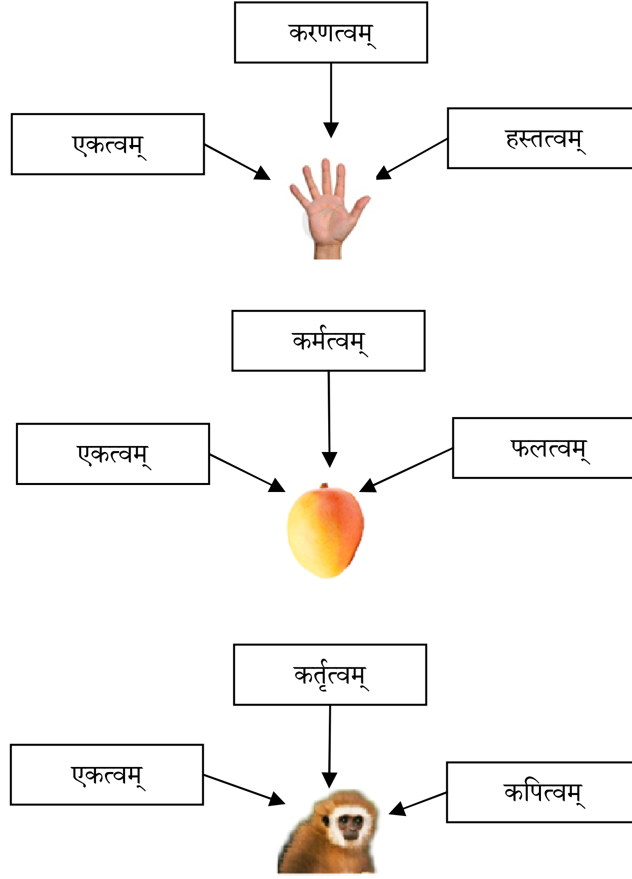


Figure 4.1

The नव्यन्याय expressions for the धर्मधर्मिभाव's are shown in the खण्डबोधाः row in Table 4.1.

पदs in व्याकरणम्	कपिः		हस्तेन		फलं		खादति	
पदs in न्याय	कपि	सु	हस्त	टा (इन)	फलं	अम्	खाद्	ति
अर्थाः		एकत्वम्		करणत्वम् एकत्वम्		कर्मत्वम् एकत्वम्	खादनक्रिया	यत्नः / कृतिः वर्तमानकालः एकवचनम्
संसर्गाः	एकत्वस्य कपौ आश्रयत्वम्		एकत्वस्य हस्ते आश्रयत्वम्, हस्तस्य करणत्वे आधेयत्वम्		एकत्वस्य फले आश्रयत्वम्, फलस्य कर्मत्वे आधेयत्वम्		कालस्य खादनक्रियायां आधेयत्वम्, क्रियायाः कृतौ जनकत्वम्	
खण्डबोधाः	एकत्वाश्रयः कपिः।		एकत्वाश्रयहस्तनिष्ठ-करणत्वम्।		एकत्वाश्रयफलनिष्ठ-कर्मत्वम्।		वर्तमानखादनजनकः प्रयत्नः।	

Table 4.1

Finally, we add the निरूप्यनिरूपकभावs. Just saying "Eats!" provokes several questions: Who eats? Eats what? Eats with what? Thus, कर्मत्वम्, करणत्वम्, कर्तृत्वम् and खादनत्वम् are all साकांक्षधर्मs. The निरूप्यनिरूपक relationships are shown in Figure 4.2.

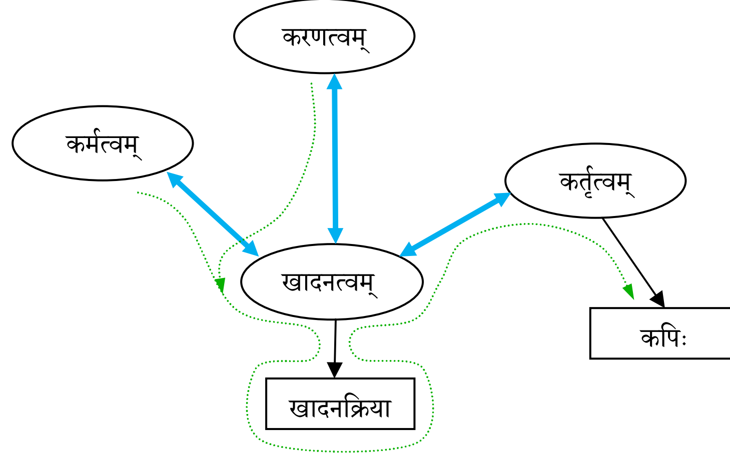


Figure 4.2

According to नैयायिकs, the import of any sentence is the कर्ता. Thus, the above sentence wants to convey information about the monkey, not about its hand or the fruit or the action of eating. Our representation should ultimately describe कपि. Visually, we can follow dotted green arrow, and end with कपिः.

In our symbolic language and using our standard shortcut, the representation without worrying about करणत्वम् will look like:

((फल ← कर्मत्व) –«– खादन) –»– कर्तृत्व) → कपिः ।

फलनिष्ठकर्मत्वनिरूपकखादननिरूपितकर्तृत्ववान् कपिः ।

Adding the करणत्वम्, we can write

([(फल ← कर्मत्व) –«–][(हस्त ← करणत्व) –«–] खादन) –»– कर्तृत्व) → कपिः ।

फलनिष्ठकर्मत्वनिरूपकहस्तनिष्ठकरणत्वनिरूपकखादननिरूपितकर्तृत्ववान् कपिः ।

Without the shortcut, we would follow the arrows in Figure 4.2 to write:

((([(फल ← कर्मत्व) –»–] [(हस्त ← करणत्व) –»–] खादनत्व) → खादन ← खादनत्व) –»– कर्तृत्व) → कपिः ।

which translates to

फलनिष्ठकर्मत्वनिरूपितहस्तनिष्ठकरणत्वनिरूपितखादनत्ववत्खादननिष्ठखादनत्वनिरूपित कर्तृत्ववान् कपिः ।

In the above sentence, we skipped the quality of एकत्व everywhere, but adding it is a piece of cake, isn't it? फल will become एकत्वाश्रयफल, कपि will become एकत्वाश्रयकपि and so on.

Do you now see how the नव्यन्याय representation naturally lends itself for implementation on a computer? Notice the nested brackets in the symbolic notation. The entire representation is

like a stack: the धर्मs, धर्मीs and the संसर्गs (relations) are the contents of the stack. (See Figure 4.3). Stacks are standard data structures that computers understand, and with a few rules, we can do whatever we wish with them.



Figure 4.3

In natural language processing, the import of any sentence or paragraph is called the **head**. All the other objects give us additional information about the head. They are called **modifiers**. In our sentence, the head was कपिः, because everything else was describing it: what it does, how does it do it, etc. As you can see, in the नव्यन्याय representation, the head appears right at the top of the stack. All the objects and relations that appear after the head are the modifiers.

Now suppose we wanted a computer to translate this sentence into Hindi. We need a standard set of rules that the computer will implement on the elements of this stack. These rules should be the same irrespective of what our sentence is and what the stack contains. We can do so with the help of a beautiful theory of language developed by the संस्कृत

grammarians, called the कारक theory. Later, we will see how the नव्यन्याय language and the कारक theory together allow us to perform *language independent parsing*. We will then return to the problem of translating the sentence to Hindi.

The theory of कारकs

The best way to explain कारकs is to look at another example that uses all (or most) of them! We will return to the above example once we understand the कारकs. Consider the following sentence:

धर्मसंस्था वर्षारम्भे छात्रेभ्यः शालायां पुस्तकानि ददाति ।
The philanthropic organization gives books to students in school at the start of the year.

According to the grammarians, the head of any sentence is the action. Everything else is related to the action. These relatives are called कारकs (literally meaning (क्रियाजनकानि) causes of the action after an amount of discussion decided as क्रियान्वयित्वं कारकत्वं relating with action.) There are six कारकs defined in पाणिनिs अष्टाध्यायी as follows (The sub variations are not mentioned).

1. कर्ता – स्वतन्त्रः कर्ता ॥ १.४.५४ ॥ कर्ता is the performer of the action.
2. कर्म – कर्तुः ईप्सिततमं कर्म ॥ १.४.४९ ॥ What the performer desires most is कर्म.

3. करण – साधकतमं करणम् ॥ १.४.४२ ॥ The most important instrument of the action is करणम्

4. अधिकरण – आधारोऽधिकरणम् ॥१-४-४५ ॥ The place or time in which the action is being performed is the अधिकरण

5. सम्प्रदान – कर्मणा यम् अभिप्रैति सः सम्प्रदानम् ॥ १.४.३२ ॥ For whom the action is being done, is सम्प्रदानम्

6. अपादान – कध्रुवमपायेऽपादानम् ॥ १-४-२४ ॥ If the action involves separation, then that from which the separation happens is अपादानम्.

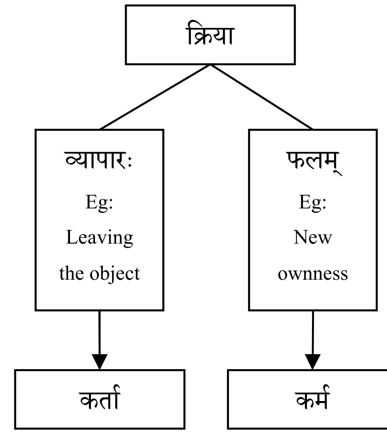


Figure 4.4

Each action has two parts: व्यापार (performance) and फल (result/culmination). For the action of giving, (स्वस्वत्वनिवृत्तिपूर्वकपरस्वत्वापादानम्) the व्यापार could be leaving the thing to be given from hand, or signing an order to that effect, etc. so that the giver loses his 'ownness' on the object and causes taker's 'ownness' on it. The result is the new ownness of the person it is being given to. The व्यापाराश्रय is the कर्ता and the फलाश्रय is the कर्म.

Let us first simply represent all the कारकs that reside in the दानक्रिया. Next, all we need to do is to put the कारकत्वं in each object by निष्ठा, set up the निरूप्यनिरूपकभावs with the क्रिया and expand it out in out नव्यन्याय representation.

Note: अधिकरण is of two types: the location in space (देशाधिकरणम्) and the location in time (कालाधिकरणम्)

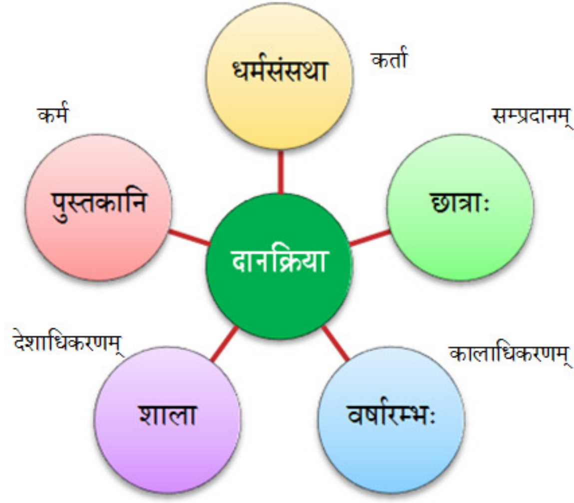


Figure 4.5

Thus,

छात्रनिष्ठसम्प्रदानत्वनिरूपक (
    वर्षारम्भनिष्ठकालाधिकरणत्वनिरूपक (
        शालानिष्ठदेशाधिकरणत्वनिरूपक (

पुस्तकनिष्ठकर्मत्वनिरूपक (
दानक्रियानिरूपितकर्तृत्ववती धर्मसंस्था।
))))

Now that you have some idea of कारकs, let us try what we promised just before this section: how to use नव्यन्याय language to do language independent parsing.

Language independent sentence parsing

We shall see two examples for illustration.

Das kind sitzt in dem zimmer. (German)

Meaning: The kid sits in the room.

Let us first analyze the word meanings. Following exactly the process that we followed in representing "कपिः हस्तेन...", the पदs are:

1. Das kind – प्रकृत्यर्थ-kind
2. <no suffix> – कर्तृत्वं, एकत्वम्
3. Sit – प्रकृत्यर्थ-sit-क्रिया
4. zt – वर्तमानकालः, एकत्वम्
5. Zimmer – प्रकृत्यर्थ-zimmer
6. in dem – अधिकरणत्वं, एकत्वम्

We have used the term "प्रकृत्यर्थ" to mean the object itself, as distinct from the suffix. Previously, we used actual pictures of

the objects to simplify life. The objects can be referred to by attaching “प्रकृत्यर्थ” to them.

The खण्डबोधाः can then be written as (for each word):

1. *Das kind* – एकत्वाश्रयप्रकृत्यर्थ-*kind*
2. *in dem zimmer* – एकत्वाश्रय-*zimmer*-निष्ठाधिकरणत्वम्
3. *sitzt* – वर्तमानकालीन-*sit*-क्रियाजनकप्रयत्नः

Putting the खण्डबोधs together, we have our final parsed sentence as follows:

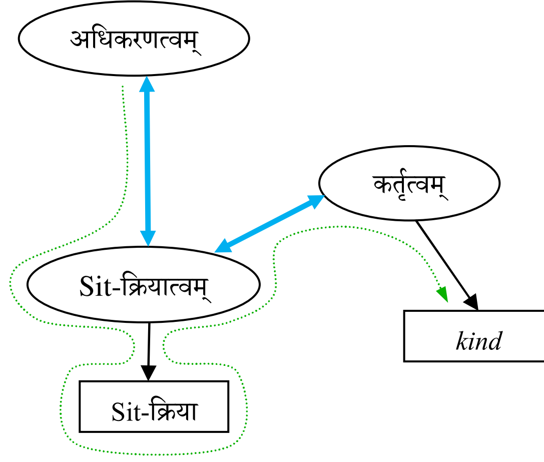


Figure 4.6

zimmer-निष्ठाधिकरणत्वनिरूपक-*sit*-क्रियानिरूपितकर्तृत्ववान् *kind*. Voila!

This looks even more elegant with symbols. All that we are left with are कारकs and original German words:

(((*zimmer*←अधिकरणत्व) –«–*sit*-क्रिया) –»– कर्तृत्व)→*kind !!*

Let us take this second example from Spanish!

Hablamos Espaňol!

Meaning: Let us speak Espaňol.

Again, let us first list out all the पदs:

1. hablar – (to speak) – hablar-क्रिया
2. mos – वर्तमानकालः, उत्तमपुरुषः, बहुवचनम्
3. Espaňol – प्रकृत्यर्थ-Espaňol
4. (Implicit) us (suffix) – कर्तृत्वम्

The word meanings can now be written as:

1. Hablamos – वर्तमानकालीन-*hablar*-क्रियाजनकप्रयत्नः
2. Espaňol – Espaňol-निष्ठकर्मत्वम्
3. (Implicit) us – उत्तमपुरुषबहुत्वविशिष्टकर्तृत्वम्

Putting together, our expression becomes:

Espaňol-निष्ठकर्मत्वनिरूपकवर्तमानकालीन-*hablar*-क्रियानिरूपितोत्तमपुरुषबहुत्वविशिष्टकर्तृत्ववन्तः वयम् ।

In Symbols: (((Espaňol-←—कर्मत्व) –«– वर्तमानकालीन-*hablar*-क्रिया) –»– उत्तमपुरुषबहुत्व{{कर्तृत्व}})→ वयम् ।

Translation

Let us now go back to the task of translating the sentence "कपिः हस्तेन फलं खादति" into Hindi. We want the computer to scan through the stack from top to bottom and work with each element.

The first to pop out is कपि. Next word to pop out is कर्तृत्ववान् which means what popped out previously was the कर्ता. In Hindi, we use no suffix for the कर्ताकारक. So कपि it is declined as "बंदर".

Next word is निरूपित, so we expect that the कर्ता is described by what follows. Next to pop out is खादनक्रिया. Though we have not included it in our representation for simplicity, the खादनक्रिया, because of the suffix ति, is qualified by एकत्वं, वर्तमानकालः, पुल्लिंगत्वं and प्रथमपुरूषत्वम्. With all these, its Hindi declension can be looked up to be "खाता है".

Next, comes निरूपक. Thus, the खादनक्रिया is a निरूपक for what follows, and what follows is करणत्वम्. We now know that we want to apply the करणकारक, so we are ready with the instrumental suffix. Next word is निष्ठ, which tells us that the suffix is to be applied to what follows, and that is हस्त. In Hindi,

the suffix for instrument would be से and hence the words would be "हाथ से".

Next, out pops निरूपक again. But since the हस्त part is already dealt with, it will be inferred that the निरूपक is still the खादनक्रिया. Next comes कर्मत्वम्, so कर्मकारक suffix is kept ready. With the following निष्ठ, we know that the next word will be the word to which कर्मत्व suffix will be applied. This word is फल, and the suffix is "को", so the word becomes "फल को".

The four words inferred are "बंदर", "खाता है", "हाथ से", and "फल को". Now we know that in Hindi, the word order is कर्ता-कर्म-करण-क्रिया, so rearranging, we get:

बंदर फल को हाथ से खाता है।   Voila!

We have hardly gotten started with the नव्यन्याय representation, and yet, here we are, already translating sentences pretty effortlessly, right? Yes, but wait and watch, for we have seen nothing yet!

Sometimes, two words appear in the same विभक्ति. In such cases, how to decide which कारक attaches to which word? In our second example ("धर्मसंस्था...") how did we conclude that शाला was the देशाधिकरण and वर्षारम्भ was the कालाधिकरण? It is impossible to tell from the sentence itself, as both are in the सप्तमी विभक्तिः। We as humans could tell this without effort because we know by

experience that start of the year corresponds to time and school corresponds to place. But how would a computer know this?

If only there were a way to tell computers what each object is capable of doing, from a realistic perspective. For example, consider the sentence

"चैत्रं मार्गं पृच्छामि" (I am asking Chaitra the road.)

Both चैत्र and मार्ग occur in the द्वितिया विभक्तिः. How do we know if the asking is being done to the road or to Chaitra? We know that it must be Chaitra, because the road cannot talk, and only a fool will expect an answer from the road. If we had a classification that tells us that Chaitra is a living thing and road is a non-living thing, and if we set a rule that the action of asking can be done only to a living thing, then our problem is solved.

What we need is an **ontological dictionary**, which categorizes each word into certain known categories, like living and non-living. Then, we could look up the ontological role of each word and check which विभक्तिs are compatible with it. We could then assign the most plausible role to that word. This is where the वैशेषिकs come into picture, for they have already done most of the job for us. In the next chapter, we will delve into the ontology of the वैशेषिकs, and towards the end of it, we shall revisit the opening paragraph from this chapter.

Chapter Five : पदार्थशास्त्रम् – The Ontology of वैशेषिकs

The world is made up of so many objects, both material and non-material. In order to unravel the functioning of the world, appropriate classification of these objects is of great value. Modern chemistry took great leaps only after it was realized that all matter is made of 108 kinds of atoms, because then, all observed substances could be explained by general laws of only those elements. Traditional knowledge systems like Ayurveda, Yoga, and Chemistry too rely heavily on proper ontology.

In this chapter, we will discuss ontology of the वैशेषिकs, which is adopted by नव्यन्याय. It must be noted that many of the concepts and arguments that वैशेषिकs give are pretty much based on the earliest वैशेषिकसूत्रs authored by महर्षि कणाद. They are therefore, based on the limited observational skills available in those times, and in many places, we may find them in conflict with the findings of modern science. However, the goal of studying them is not to accept everything literally, but rather, to understand the thought process which shaped those ideas.

Even so, it is astounding to see that so many concepts have been correctly explained by the वैशेषिकs only by rigorous reasoning with little aid of sophisticated observational instruments. For instance, Jain नैयायिकs seem to have figured out that we see objects because light reflected from them enters our eye, when everyone else believed otherwise. Many other ideas have not even been experimentally explored, and may well provide direction for new research.

Ontology is the rigorous hierarchical organization of a knowledge domain. We have seen before that the वैशेषिक philosophy is called **पदार्थशास्त्रम्** (the science of पदार्थs). What is a पदार्थ? अन्नम्भट्ट defines it as "अभिधेयत्वं पदार्थसामान्यलक्षणम्" which means "Anything that can be expressed in words is called a पदार्थ". This definition may sound weird, but think about it. Out of all that we see, feel or experience, can we express everything in words? At least poets will certainly disagree! Only those words are meaningful which generate the same cognition in everyone. Objects denoted only by such words can become पदार्थ. Indeed, पदार्थ itself means पदस्य अर्थः, i.e. the object denoted by that word.

The **तर्कसंग्रह**, a famous treatise on नव्यन्याय authored by अन्नम्भट्ट in the sixteenth century, starts with the classification of पदार्थs thus:

द्रव्यगुणकर्मसामान्यविशेषसमवायाभावाः सप्तपदार्थाः ॥ १ ॥

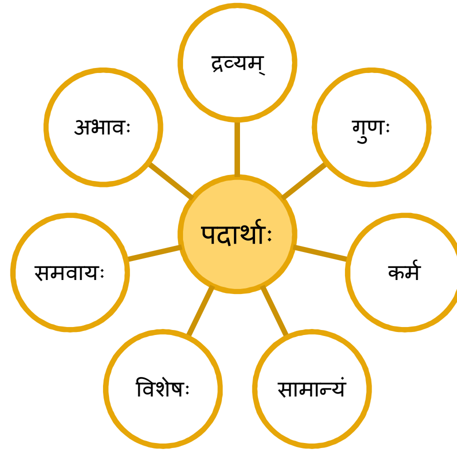


Figure 5.1

There are seven पदार्थs classified as follows (Figure 5.1).

नैयायिकs are realists. They believe that whatever cannot be expressed in words cannot exist

in reality, and are concerned with only things that do exist (these are the पदार्थs). They further assert that everything that exists can be classified into seven categories only, but not all schools of philosophy agree.

Commentators on this text pose the question, “What is the use of the word सप्त when we can count the पदार्थs and see clearly that there are seven”? अन्नम्भट्ट explains, “The word सप्त is used to emphasize that there are seven and only seven categories, no more and no less”. This is to oppose other philosophers who assume different number of पदार्थs: वैशेषिकs count 6, वेदान्तिन्s

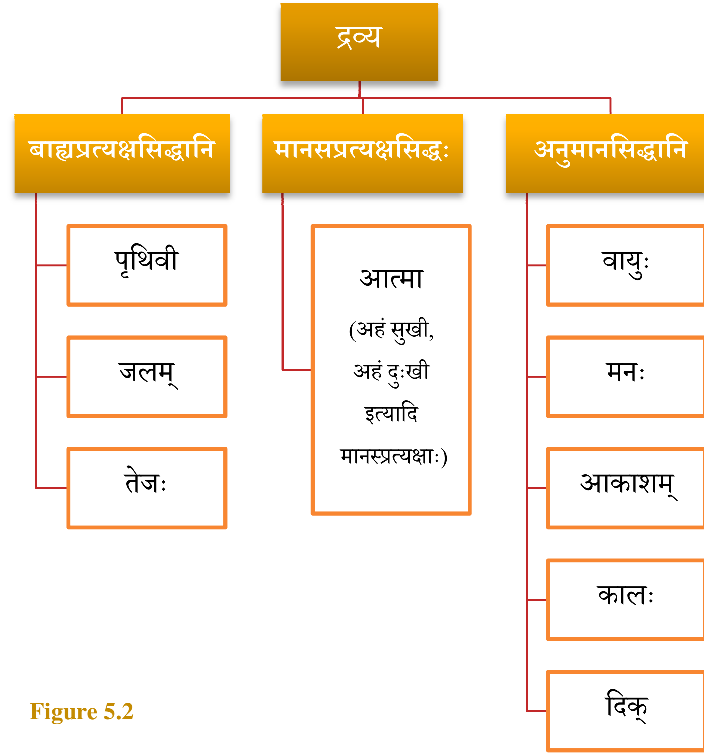


Figure 5.2

variously count 2 or more, सांख्यs count 25, and मीमांसकs count 8! अन्नम्भट्ट then proceeds to subdivide each पदार्थ.

तत्र द्रव्याणि पृथिव्यप्तेजोवाय्वाकाशकालदिगात्ममनांसि नवैव ॥ २ ॥

In these (पदार्थs) द्रव्यs are nine only, and they are पृथिवी, जल, तेजस्, वायु, आकाश, काल, दिक्, आत्मन्, and मनस्.

What is a द्रव्य? Here are four technical definitions: 1) द्रव्यत्वजातिमत्त्वम् (That which has a common quality) 2) गुणवत्त्वम् (that which has a characteristic quality) 3) क्रियावत्त्वम् (that which can perform actions) 4) समवायिकारणत्वम् (that which has an inherent cause).

But a वेदान्तिन् objects, "All of these definitions are highly jargonized. Why don't you simply accept my definition? द्रवणप्राप्यत्वेन द्रव्यत्वम् ।" And indeed, this definition is quite elegant. It says, "द्रव्य is anything that can be obtained by a flowing movement". Thus paper is a द्रव्य because we can obtain it by moving our hand and grabbing it. But we cannot so obtain its white colour, and so colour is not a द्रव्य.

Not all द्रव्यs can be perceived, let alone obtained. For example, आत्मा cannot be perceived by any sense organ. But since we have the feeling of "I-ness" in experiences such as "I am happy" (अहं सुखी) etc, the "I" must refer to something real. That 'something' is called आत्मा, whose existence can be felt, but not through any

sense organ. Therefore, it is a **मानसप्रत्यक्षसिद्धः**. Those द्रव्यs that can be directly perceived by the sense organs are called **बाह्यप्रत्यक्षसिद्ध** and those that can be known only by inference are called **अनुमानसिद्ध**. (See Figure 5.2)

Once again, we see a forceful assertion that द्रव्यs are "nine *only*". This is to counter the view that darkness may also be considered as a tenth द्रव्य. After a long discussion, अन्नम्भट्ट concludes that darkness cannot be counted as a separate द्रव्य and hence द्रव्यs are nine only. Next, he classifies गुण.

रूपरसगन्धस्पर्शसंख्यापरिमाणपृथक्त्वसंयोगविभागपरत्वापरत्व-गुरुत्वद्रवत्वस्नेहशब्दबुद्धिसुखदुःखेच्छाद्वेषप्रयत्नधर्माधर्म-संस्काराश्चतुर्विंशतिगुणाः ॥ ३ ॥

गुणs are 24: रूप, रस, गन्ध, स्पर्श, संख्या, परिमाण, पृथक्त्व, संयोग, विभाग, परत्व, अपरत्व, गुरुत्व, द्रवत्व, स्नेह, शब्द, बुद्धि, सुख, दुःख, इच्छा, द्वेष, प्रयत्न, धर्म, अधर्म, and संस्कार.

गुण is essentially a characteristic of any द्रव्य. The text भाषापरिच्छेद defines it as: द्रव्याश्रिता ज्ञेया निर्गुणा निष्क्रिया गुणाः ॥ ८७ ॥, meaning "those that reside in द्रव्यs, which can be known, but do not themselves contain गुणs, which cannot perform any actions, are गुणs", which is essentially same as the definition from the वैशेषिक सूत्रs: द्रव्याश्रयी न गुणवान् संयोगविभागेष्वकारणमनपेक्ष इति गुणलक्षणम् ॥ १.१.१६ ॥.

Commentators on this text give long lists of गुणs contained in many different द्रव्यs, for example:

द्रव्य	**गुणs contained**
वायु	स्पर्श, संख्या, परिमाण, पृथक्त्व, संयोग, विभाग, परत्व, अपरत्व, and a संस्कार named वेग (speed)
आत्मा	बुद्धि, सुख, दुःख, इच्छा, द्वेष, संख्या, परिमाण, पृथक्त्व, संयोग, विभाग, धर्म, अधर्म, भावना
ईश्वर	संख्या, परिमाण, पृथक्त्व, संयोग, विभाग, बुद्धि, इच्छा, प्रयत्न

उत्क्षेपणावक्षेपणाकुञ्चनप्रसारणगमनानि पञ्चकर्माणि ॥ ४ ॥

The five types of कर्म (action) are: उत्क्षेपण (throwing up), अवक्षेपण (throwing down), आकुञ्चन (contraction), प्रसारण (expansion), गमन (going)!

अन्नम्भट्ट defines कर्म as: संयोगभिन्नत्वे सति संयोगासमवायिकारणं कर्म । i.e. “कर्म is the inherent cause of contact, but is not itself contact.” The movement of our hand to grab a book becomes the *cause of contact* between the hand and the book, and so the movement is a कर्म. But the contact between the hand and the book becomes the *cause of contact* between the body and the book, and yet is not a कर्म.

There is not much exposition about the types of कर्म, nor do later नैयायिकs consider it very useful. However, the usual tradition in Indian writers is to not discard anything, and this classification is retained because it was done by मुनीs!

परमपरं चेति द्विविधं सामान्यम् ॥ ५ ॥

सामान्य is of two types: पर and अपर.

What is सामान्य? अन्नम्भट्ट says: नित्यम् एकम् अनेकानुगतम् । i.e. that which is one, but is common to many. Thus सामान्य occurs due to sameness of qualities in many objects. For example, in all pots, the quality of potness is the सामान्यं. It is of two types: पर is that which resides in only one object, like सत्ता, and अपर is that which resides in multiple objects, like घटत्वम्.

An interesting point is made by कणाद in the वैशेषिक सूत्रs: सामान्यं विशेष इति बुद्धिसापेक्षम् ॥ १.२.३ ॥ i.e. whether a quality is सामान्य or विशेष is a matter of perspective. For instance, if I am talking of घटत्वं as residing in all pots, then it is a सामान्य, whereas if it is in context of differentiating a pot from a cloth, it is a विशेष.

Sentences like "Fire is the cause of heat" (वह्निः उष्णकारणम्) are expressed precisely using सामान्यs as – वह्नित्वावच्छिन्नकारणतानिरूपितम् उष्णत्वावच्छिन्नं कार्यत्वम् ।

नित्यद्रव्यवृत्तयो विशेषास्त्वनन्ता एव ॥ ६ ॥

विशेषs reside in eternal द्रव्यs and are infinite in number. विशेष resides in the atoms of पृथिवी, जलं, तेजस्, and वायुः. It also resides in आकाशः, आत्मा, कालः, दिक्, and मनस्.

विशेष is the पदार्थ that differentiates is the keystone of वैशेषिक philosophy. Indeed the very name of वैशेषिकs comes from it. If we were to name one single feature that separates वैशेषिक philosophy from all others, it would be विशेष.

The idea of विशेष comes from the necessity to answer this question: What separates one object from another? For example, what separates a cloth from a pot? वैशेषिकs say, a pot is different from a cloth because its अवयवs, i.e. constituent parts are different. Again, what makes those parts different? Their parts. Ultimately, we will reach a stage where we can no longer divide the constituents further. These indivisible constituents are called परमाणुs (atoms). Tracing back, the cloth and the pot are different because their atoms are different. But what makes the atoms different? It is the presence of विशेष.

It is notable that नव्यनैयायिकs reject the concept of विशेष. They argue that if विशेष is required to distinguish two kinds of atoms, then what distinguishes those two विशेषs? Again, if you say that the विशेषs are inherently different, why not assume that inherent difference in the Atoms themselves? प्रशस्तपाद has tried to justify the वैशेषिक position. He gives an analogy: just as dog-flesh is inherently impure and causes impurity in whatever comes in

contact with it, विशेषs are inherently distinct and cause distinctness in whatever they reside in.

Next, अन्नम्भट्ट describes समवाय.

समवायस्त्वेक एव ॥ ७ ॥

समवाय is one only.

समवाय literally means eternal proximity or inseparable relationship. We have already got familiar with it in Chapter Three. सामान्य, विशेष and समवाय are the three features that separate न्याय philosophy from all others. The entire theory of cause and effect relationships in न्याय is based on सामान्य.

Next, अन्नम्भट्ट describes अभावः.

अभावश्चतुर्विधः – प्रागभावः प्रध्वंसाभावोऽत्यन्ताभावोऽन्योन्याभावश्चेति ॥ ८ ॥

अभाव (Absence) is of 4 types:

1. Absence before production
2. Absence after destruction
3. Ultimate absence
4. Mutual absence: घटः पटः न / नास्ति / न भवति । Cloth is not a pot.

Having defined all the पदार्थs, अन्नम्भट्ट proceeds to classify the द्रव्यs, the first of which is पृथिवी, Earth.

तत्र गन्धवती पृथिवी । सा द्विविधा – नित्यानित्या च । नित्या परमाणुरूपा । अनित्या कार्यरूपा । पुन्स्त्रिविधा - शरीरेन्द्रियविषयभेदात् । शरीरम् अस्मदादीनाम् । इन्द्रियं गन्धग्राहकं घ्राणं नासाग्रवर्ति । विषयो मृत्पाषाणादिः ॥ ९ ॥

In those (nine द्रव्यs), Earth is that which has smell. It is of two types: eternal and non-eternal. Eternal part is Atom. Non-eternal is that which is a specific outcome of some action. Alternatively, we can divide it into three types: body, sense organ and objects of cognition. Body is like ours. Sense organ is that which captures smell and resides at the tip of the nose. Objects of cognition are mud, stones, etc.

In the तर्कसंग्रह, this scheme of classification is used for all the बाह्यप्रत्यक्ष द्रव्यs. Each of the four द्रव्यs is classified by two ways. Since the Atoms are eternal, they form the eternal component of the द्रव्यs. Whatever is created out of the Atoms, like the objects we sense, will be destroyed eventually, and therefore, are non-eternal. Each द्रव्य is associated with a particular गुण. This leads to the second classification: the body that is composed of that द्रव्य, the इन्द्रिय which captures the गुण associated with it, and the other material objects composed of that द्रव्य.

शीतस्पर्शवत्य आपः । ता द्विविधा – नित्या अनित्याश्च । नित्याः परमाणुरूपाः । अनित्याः कार्यरूपाः । पुन्स्त्रिविधा - शरीरेन्द्रियविषयभेदात् । शरीरं वरुणलोके । इन्द्रियं रसग्राहकं रसनं जिव्हाग्रवर्ति । विषयः सरित्समुद्रादिः ॥ १० ॥

Water is that which is cold to touch. It is of two types: eternal and non-eternal. Eternal part is Atom. Non-eternal is that which is a specific outcome of some action. Alternatively, we can divide it into three types: body, sense organ and objects of cognition. Body is found in the realm god वरुण*. Sense organ is that which captures taste and resides at the tip of the tongue. Objects of cognition are rivers, sea, etc.*

उष्णस्पर्शवत्तेजः । ततद्द्विविधम् – नित्यमनित्यं च । नित्यं परमाणुरूपम् । अनित्यं कार्यरूपम् । पुन्स्त्रिविधम् - शरीरेन्द्रियविषयभेदात् । शरीरम् आदित्यलोके । इन्द्रियं रूपग्राहकं चक्षुः कृष्णताराग्रवर्ति । विषयश्चतुर्विधः - भौमदिव्यौदर्याकरजभेदात् । भौमं वह्नियादिकम् । अबिन्धनं दिव्यं विद्युदादि । भुक्तस्य परिणामहेतुरौदर्यम् । आकरजं सुवर्णादि ॥ ११ ॥

Fire is that which is hot to touch. It is of two types: eternal and non-eternal. Eternal part is Atom. Non-eternal is that which is a specific outcome of some action. Alternatively, we can divide it into three types: body, sense organ and objects of cognition. Body is found in the realm of god Aditya. Sense organ is that which captures sight and resides at the black circle of the eye. Objects of cognition are of four types: earthly, divine, औदर्य*,* आकरज*. Fire is earthly. Lightening is divine. The "fire" in the stomach that causes digestion is* औदर्य*. Glittering metals like gold are* आकरज*.*

रूपरहितस्पर्शवान् वायुः । स द्विविधः – नित्योऽनित्यश्च । नित्यः परमाणुरूपः । अनित्यः कार्यरूपः । पुन्स्त्रिविधः - शरीरेन्द्रियविषयभेदात् ।

शरीरं वायुलोके । इन्द्रियं स्पर्शग्राहकं त्वक्सर्वशरीरवर्ति । विषयो वृक्षादिकम्पनहेतुः ॥ १२ ॥

Wind is that which is invisible but can be felt by touch. It is of two types: eternal and non-eternal. Eternal part is Atom. Non-eternal is that which is a specific outcome of some action. Alternatively, we can divide it into three types: body, sense organ and objects of cognition. Body is found in the realm god वायु. Sense organ is the skin that resides all over the body. Object is cognition is that because of which trees vibrate.

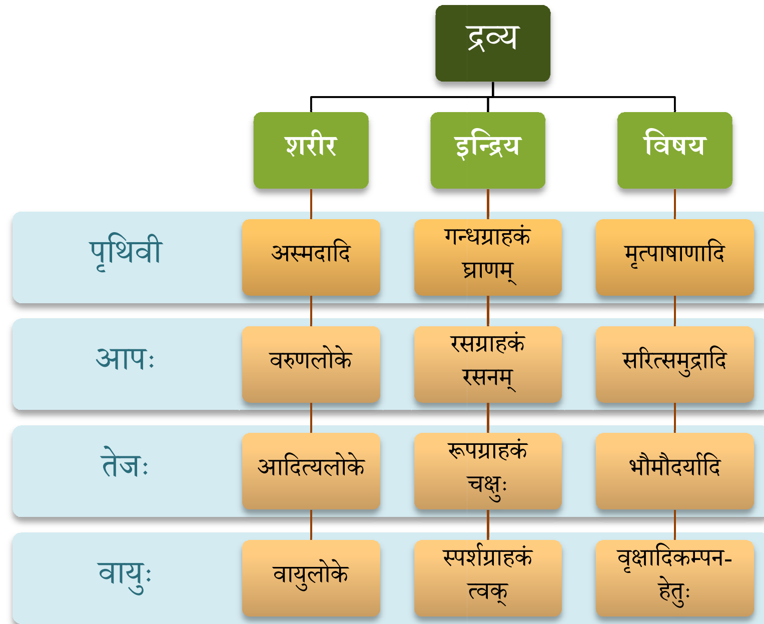


Figure 5.3

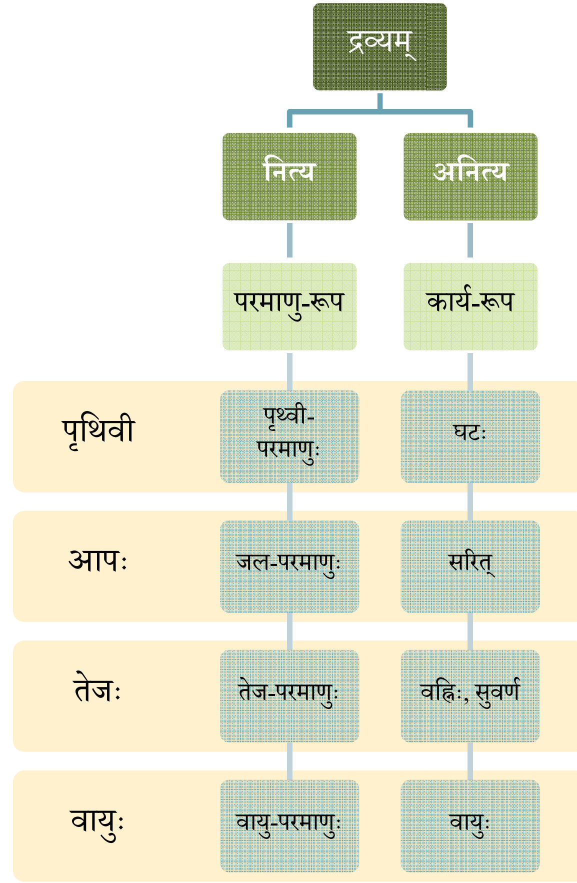


Figure 5.4

वायुः is अनुमानसिद्धः – known only by inference. The तर्कसंग्रहदीपिका says "स्पर्शानुमेयो वायुः", i.e. inferred from touch sensation, but cannot be seen.

शब्दगुणकमाकाशम्। तच्चैकं विभु नित्यं च ॥ १३ ॥

That which is has the quality of sound is Space. It is one only, all pervading and eternal.

अतीतादिव्यवहारहेतुः कालः। स चैको विभुर्नित्यश्च ॥ १४ ॥

Time is for saying things like "in the past…", etc. It is also one only, all pervading and eternal.

प्राच्यादिव्यवहारहेतुर्दिक्। सा चैका विभ्वी नित्या च ॥ १५ ॥

Direction is for saying things like "in the east…" etc. It is also one only, all pervading and eternal.

ज्ञानाधिकरणमात्मा। स द्विविधः – परमात्मा जीवात्मा च। तत्रेश्वरः सर्वज्ञः परमात्मैक एव। जीवात्मा प्रतिशरीरं भिन्नो विभुर्नित्यश्च ॥ १६ ॥

The place wherein cognition happens is Atman. It is of two types: Individual and God. God is all-knower, supreme and One only. Individual is different in each body, all pervading, and eternal.

In the very beginning, we asked the question: How do नैयायिकs argue for the existence of आत्मा as separate from the body and mind? The time has now come to answer that question. Firstly, note that we can sense the existence of ourselves when we say "I am happy", "I am sad" etc. Let us call this self as Atman. Atman is a "मानसप्रत्यक्षसिद्ध", i.e. it can be directly perceived by the mind.

Where does cognition take place? नैयायिकs argue that four objects and three connections are required for cognition to happen. (Figure 5.5) In order to see why these are necessary, let us remove each of them one by one and see if cognition is possible.



Figure 5.5

Object: If we remove the object, then of course, there is nothing to cognize, so object is necessary.

Sense Organ: We know that people who are missing sense organs cannot get cognition from that particular organ, just as a blind man cannot get visual cognition.

Mind: Sometimes, we experience that even when the senses are working, we do not get cognition of things around us, for example, when we are deeply involved in something else. For example, when listening to music, sometimes we don't even notice if a friend pinches us.

Atman: Cognition begins with the sense object, and it must end somewhere. It cannot end in the mind, as we will soon see. Hence we need a place where cognition ends, and that is Atman.

Now we should be able to justify that the cognition ends in Atman, and not in the mind or sense organs. Let us call this place where the cognition ends as ज्ञानाधिकरणं "seat of cognition", and rule out the first three one by one.

The ज्ञानाधिकरण cannot be the material objects, because they themselves are being cognized, and the person who is getting the cognition is distinct from them.

It cannot be the sense organs either. Suppose that they were. Then, the memory of whatever has been seen will reside in the eyes. Then, if a person loses, eyesight, this memory will be lost. But we see that this is not so, and thus, ज्ञानाधिकरण must be distinct from the sense organs. Another argument goes thus: We can say, "I, who saw an object, am touching it." If the sense organ were ज्ञानाधिकरणs, then there would be five different ज्ञानाधिकरणs, and the same person getting all cognitions would have been impossible. So ज्ञानाधिकरण is one only.

Now it may be argued that the mind itself is the ज्ञानाधिकरणं. What is the need of an Atman separate from the mind? To answer this question, we must first show that Atman must be विभु (all-pervading).

Atman cannot be of the size of the Atom, because then, it would no longer remain an object of direct experience. (By a different set of arguments, नैयायिकs show that atoms cannot be cogised directly, they must be inferred.) It cannot be the size of the body, because if so, the Atman of a baby will have to grow larger as the baby grows. Similarly, how is it possible that the Atman of an ant becomes that of an elephant in the next birth? We are left with no option but to assume that Atman is विभु i.e. infinite.

Now if Atman is all-pervading, it is always in contact with everything, including the sense organs. Moreover, the sense organs are present at all times, even during sleep. Yet, there is not cognition during sleep. So there must exist some agent that breaks the contact between atman and the sense organs during sleep. This agent is the mind.

Cognition resides in Atman by समवाय. समवाय is necessary to exclude काल and दिक्, which also become the base (अधिकरण) for everything by कालिक and देशिक relations.

सुखाद्युपलब्धिसाधनमिन्द्रियं मनः । तच्च प्रत्यात्मनियतत्वादनन्तं परमाणुरूपं नित्यं च ॥ १७ ॥

Mind is that sense organ which aids in the cognition of happiness, sorrow, etc. It is different in each body, is infinite in number, and is of the nature of Atom. It is eternal.

Mind is the instrument of cognition. How does the mind prevent cognition during sleep? नैयायिकs say that it enters a certain नाडी called पुरीतत् during sleep, where even though it is in contact with all-pervading atman, it is incapable of generating cognition. This argument is not very satisfactory, but is like a necessary evil. It is based directly on a verse from the बृहदारण्यकोपनिषद्:

अथ यदा सुषुप्तो भवति यदा न यस्य च वेद हिता नाम नाड्यो द्वासप्तति सहस्राणि हृदयात् पुरीततमभिप्रतिष्ठन्ते ताभिः प्रत्यवसृत्य पुरीतति शेते ॥ ४.१.१९ ॥

During sleep, the mind, having gone through the 72000 नाडीs, sleeps in the पुरीतत्.

The तर्कसंग्रह proceeds to great depths in its classifications, but let us stop here as we now have sense of how the वैशेषिक mind works. In the previous chapter, we claimed that once we have studied ontology, we should be able to perform word meaning disambiguation. Let us now revisit our example from the previous chapter to see how, in principle, this can be achieved. (which should be read as "we skip all boring technical details").

धर्मसंस्था वर्षारम्भे पाठशालायां छात्रेभ्यः पुस्तकानि ददाति ।

We need a way to disambiguate the सप्तमी विभक्तिः applied to the two words – धर्मसंस्था and पाठशाला. What we lacked till the previous chapter was an ontological dictionary. Now suppose we did have a dictionary like that, and it retrieved information for us in the following way:

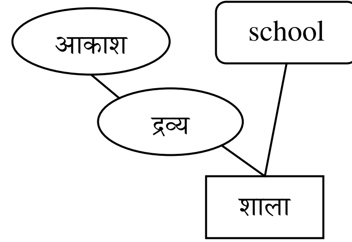


Figure 5.6

We would infer that since शाला has a द्रव्य of आकाश, the सप्तमी विभक्तिः must stand for a locative for space: देशाधिकरणम्.

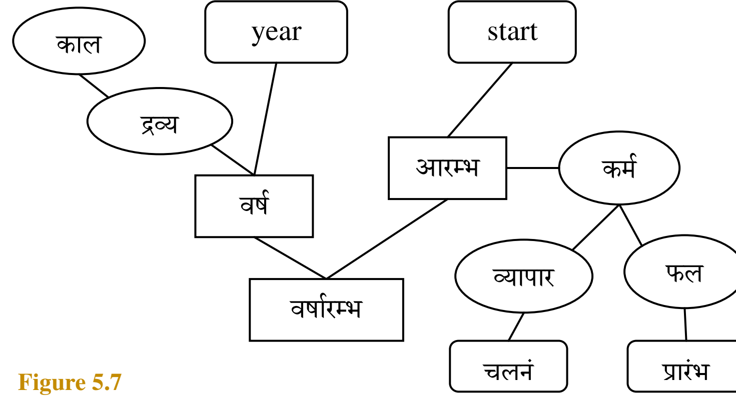


Figure 5.7

Similarly, if we see the वर्षारम्भ, we see that वर्ष denotes काल, and आरम्भ denotes a क्रिया with "start" as the फल. Thus, we conclude that वर्षारम्भ + सप्तमी विभक्तिः denotes a locative in time: कालाधिकरण.

This is how ontology can, in principle, come to our rescue in disambiguation. Of course, the technical details of actually implementing a parser which considers ontology are highly complex, and are a matter of active research. For example, see (Nair & Kulkarni, ????), which formulates an explicit representation for the knowledge structure in the Amarakosha, a Sanskrit dictionary which implicitly also gives ontological information; and (Kulkarni, Shukl, & Pokar, ????) for another way to resolve ambiguities by using the concepts of आकाङ्क्षा and सन्निधि.

In the previous chapter, we started with a short paragraph on Jhansi Rani Lakshmibai, and said that we would eventually like to translate, summarize and analyze entire paragraphs. An

efficient way to do this using the concept of “सङ्गति” is described in (Subalalitha & Parthasarathi, ????). Here, let us see just in outline, how this could is achieved.

सङ्गति is the relation between sentences. So our entire paragraph, consisting of four sentences, can be drawn in outline as in

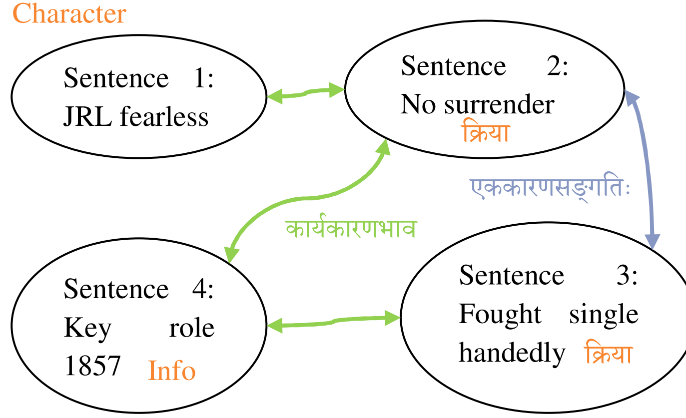


Figure 5.8

We say in the first sentence that “Jhasi Rani Lakshmibai was fearless” because of the fact that she showed fearlessness (भयाभावः) by not surrendering her kingdom (धैर्यात् अचलनाभावः). From our dictionary, we conclude that भयाभावः = धैर्यम्, and from our ontological dictionary, we conclude that अचलनम् = क्रिया = कारण, and fearlessness = भयाभाववत्ता = गुण = कार्य. We can thus assign the कार्यकारणभावः between sentence 1 and 2.

Next, we see that both sentence 2 and 3 are denoting क्रियाs, and both have धैर्यात् अचलनत्वम् as the फल, so we assign the एककारणसङ्गति between these sentences. This automatically creates कार्यकारणभावः between sentences 1 and 3.

Finally, we see that sentence 4 is in additional praise of Jhansi Rani Lakshmibai, and it is this sentence where the intention of the paragraph is emphasized. It is termed technically as an "अर्थवादवाक्यं".

In न्याय, the sentence representation always ends with the कर्ता. But मीमांसकs say that what is important is not the कर्ता himself, but the motivation that we should derive from the action that the कर्ता does. If we use the मीमांसकs' viewpoint to represent our paragraph at the last level, we will be able to capture the import of the paragraph, which can further be used in accurate translation or summarization. Of course, we have taken a lot of things for granted while trying to represent the paragraph. Deducing relations between sentences is no easy task. The import of this section was merely to introduce an idea (dealt with greater rigour in (Subalalitha & Parthasarathi, ????)).

That is the power of ontology. In his book on Knowledge Representation, John. F. Sowa elaborates the importance of Ontology for a good system of reasoning (Sowa, 2000). According to him, people who bridge human ideas with machines are Knowledge Engineers. Since the Nyaya-Vaisheshika school developed both the Ontology and Epistemology soundly, historically played the role of 'Knowledge Engineer'. People from other schools chose their

epistemology and ontology in debates, not only because it was neutral for them, but also because it provided a sound platform to express ideas.

Chapter Six : प्रमाणशास्त्रम् – The epistemology of the नैयायिकs

In this chapter, we really enter into the heart of न्यायशास्त्रम्.

If you are walking on the road and some stranger walks up to you and tells you, "There is a pile of gold a few steps ahead," would you believe him? Probably not. You will walk with suspicion. But indeed, after walking some distance, you see a glittering yellow substance on the ground. This time, you would most likely believe your eyes and conclude that it is gold.

How did you decide what to accept as true knowledge and what to reject? You probably decided it by experience. You knew that so far, whatever your eyes saw had turned out to be true. But as a kid, your parents taught you never to trust strangers, so you did not believe everything that you heard from them. If, instead of a stranger, it were your friend, you would have probably trusted him.

This is the question that haunted the नैयायिक's brain: What are the means of valid knowledge? Indeed, the very first word of the very first न्यायसूत्र is none other than प्रमाण! Only by dispelling false knowledge, say the नैयायिकs, can you obtain freedom from sorrow. In this chapter, we will explore the three types of cognition and the means of valid knowledge as accepted by the नैयायिकs.

The three types of cognition

Once upon a time, in a small village, an elderly woman was going home after a day's work. When she reached her house and opened the door, she screamed in a frightened voice "Snake! There is a snake inside!" All the villagers rushed to her aid with sticks and torches. Carefully, they opened the door with the aim of returning the animal to the forest, and dashed in, only to find that the thing lying on the floor was merely a rope! The cognition that the elderly woman got was a false cognition. It is called a **भ्रमः**. In the torchlight, the cognition that everyone else got was correct cognition, called **प्रमा**. It is always प्रमा that we are after. A third kind of cognition is indecision, where you know something is present, but cannot ascertain what it is. It is called **अनिश्चयः**.

Let us see how to represent these different types of cognitions technically. The true situation prevailing in the room is as shown in Figure 6.1.

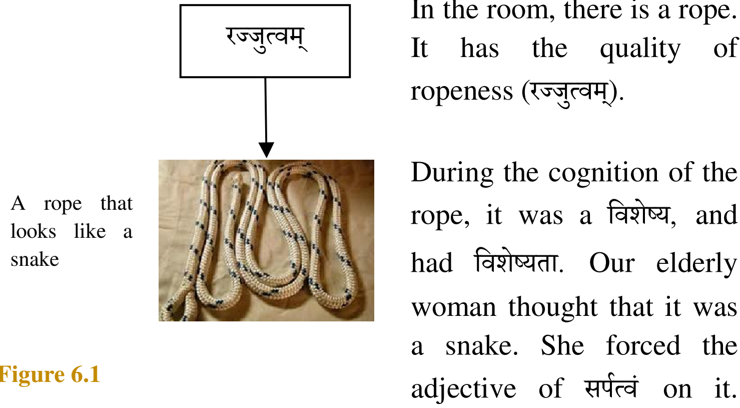


Figure 6.1

In the room, there is a rope. It has the quality of ropeness (रज्जुत्वम्).

During the cognition of the rope, it was a विशेष्य, and had विशेष्यता. Our elderly woman thought that it was a snake. She forced the adjective of सर्पत्वं on it.

Therefore, विशेषणता / प्रकारता lay in सर्पत्वम्, which was not at all present in reality. The full picture is shown in Figure 6.2. Also note that since we are talking about the cognition, our representation should end with ज्ञानम्. It is not explicitly shown in the figure.

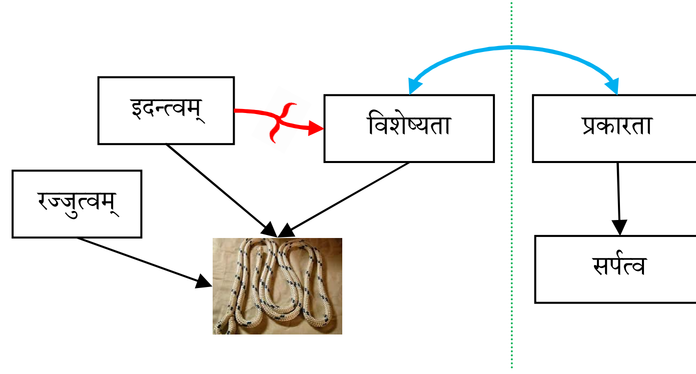


Figure 6.2

Following Figure 6.2, we can represent this cognition as इदन्त्वावच्छिन्नरजुनिष्ठविशेष्यतानिरूपितसर्पत्वनिष्ठप्रकारतानिरूपकं ज्ञानम् ।

In symbols, (इदन्त्व{रज्जु←विशेष्यता} –»– (सर्पत्व←प्रकारता)) –«– ज्ञानम्.

The तर्कसंग्रह gives an elegant definition of भ्रमः –

तदभाववति तत्प्रकारकोऽनुभवोऽयथार्थः ॥

Cognition of the nature of x in that which does not contain x is incorrect cognition. (अयथार्थ or भ्रमः). Here, तत् is x, the usual

unknown in mathematics that can denote whatever we want it to.

In our example, x is snake-ness. तदभाववत् is the rope as there is absence of snake-ness in the rope. Yet, we got the x-प्रकारक cognition, i.e. cognition of snake-ness in it. Hence it was an incorrect cognition.

Now when the villagers come to the elderly woman's rescue, the torchlight revealed the rope-ness that was present in the rope, as in Figure 6.3.

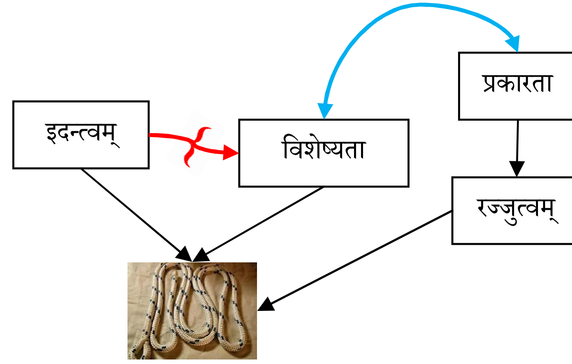


Figure 6.3

This translates to our language as इदन्त्वावच्छिन्नरजुनिष्ठविशेष्यतानिरूपितरज्जुत्वनिष्ठप्रकारतानिरूपकं ज्ञानम्।

In symbols, (इदन्त्व{रज्जु←विशेष्यता} –»– (रज्जुत्व←प्रकारता)) –«– ज्ञानम्.

प्रमा is defined in the तर्कसंग्रह as:

तद्वति तत्प्रकारकोऽनुभवो यथार्थः। सैव प्रमेत्युच्यते ॥

Cognition of the nature of x in that which contains x is correct cognition (यथार्थ). That alone is called प्रमा.

Here, x is rope-ness, which gets cognized and does indeed reside in the rope.

Finally, अनिश्चय means ‘she is seeing the object as a snake, but it is not known whether it is really a snake or not’. Even in this situation the perception she gets is “अयं सर्पः”. This could be drawn as in Figure 6.4.

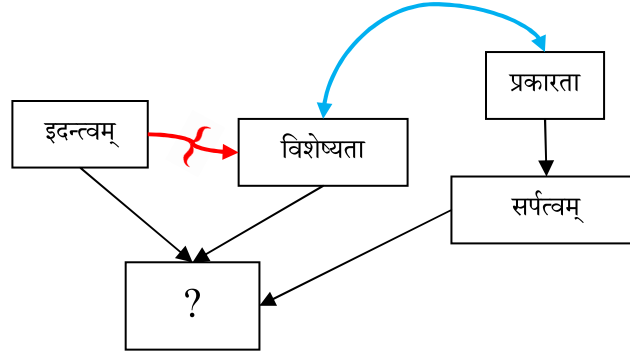


Figure 6.4

In our नव्यन्याय language, इदन्त्वावच्छिन्नविशेष्यतानिरूपितसर्पत्वनिष्ठप्रकारतानिरूपकं ज्ञानम्।

In symbols, (इदन्त्व{विशेष्यता} –»– (सर्पत्व←प्रकारता)) –«– ज्ञानम्.

We now know precisely what is meant by true knowledge, false knowledge, and indecision. (Thanks to the power of नव्यन्याय language). However, knowing this alone is not sufficient in day to day life, let alone in obtaining निःश्रेयस. What we really seek are the means to obtain correct knowledge and dispel false knowledge. We shall start our search in the next section.

प्रमाणs – the means to valid knowledge

The world is full of objects. We are in search of toolsto cognize them correctly, for example, cognition of घटत्व in घट or पटत्व in पट. The नैयायिकs divide प्रमा into four categories:

1. प्रत्यक्षप्रमा – Cognition by direct perception
2. अनुमितिः – Inference
3. उपमितिः – Identification based on similarity
4. शाब्दबोधः – The cognition of/by words or speech

Now each type of प्रमा requires its own instrument. The instrument of प्रमा is **प्रमाण**. Thus the प्रमाणs are also four:

1. प्रत्यक्ष – Direct perception by sense organs
2. अनुमान – The inferential process
3. उपमान – Recalling of similarity
4. शब्द – word or speech

Let us see how each one works.

In the तर्कसंग्रह, प्रत्यक्षम् is defined as follows:

इन्द्रियार्थसन्निकर्षजन्यं ज्ञानं प्रत्यक्षम्। तद्द्विविधम्। निर्विकल्पं सविकल्पम् चेति ॥

Direct perception is the cognition arising from contact between the object and sense organ. It is of two types: निर्विकल्प (without qualities) and सविकल्प (with qualities).

When our eye gets connected with an object, we feel its shape, its colour, its size, and many other qualities. Thus, our cognition of the object is utterly subject to the qualities of that object. Without qualities there would be no cognition. This kind of cognition is what is called as सविकल्पं ज्ञानम्.

Now such cognition is विशिष्टबुद्धिः (remember Chapter Three?). If विशिष्टबुद्धि is the effect, the cause must be knowledge of the विशेषणs (विशेषणज्ञान). If we say that this knowledge of the विशेषणs is also a विशिष्टबुद्धि, then we may again ask, what is the cause of that knowledge? We thus enter into an infinite recursion. To avoid this, नैयायिकs have conceived the concept of निर्विकल्पज्ञानम्. The knowledge of the विशेषण is निर्विकल्प, i.e. without qualities, and therefore does not require any prior knowledge. निर्विकल्पज्ञान is the first cognition of the विशेषण, विशेष्य and संसर्ग in the object, cognized separately.

That is the nature of प्रत्यक्ष. It is ज्ञानाकरणकं (ज्ञान+अकरणकम्), that which does not require any prior knowledge as its instrument. Therefore, it is the most authoritative instrument of cognition. It cannot be challenged.

अनुमानम्

The second instrument of valid knowledge is inference. Inference is defined in the तर्कसंग्रह as

परामर्शजन्यं ज्ञानमनुमितिः । व्याप्तिविशिष्टपक्षधर्मताज्ञानं परामर्शः ।

Knowledge generated from परामर्श is called inference. परामर्श is the ....

In western logic, inference usually follows a three step process, consisting of induction and deduction. For example, consider the following statements:

Premise: All lions are yellow.
Observation: Simba is a lion.
Conclusion: Therefore Simba is yellow. (by deduction)

The correctness of the conclusion depends on the correctness of the premise. As long as the premise is correct, the conclusion will be correct. In reality however, the premise is usually either an assumption (axiom) or is obtained by observation and induction. The premise in the above example could be obtained as follows: We have so far observed 57012 lions. All of them have turned out to be yellow. There is thus reason to believe that 57013rd lion will also be yellow, and by induction, all lions are

yellow. The typical न्याय example is of the mountain on fire, which goes thus:

Premise: Wherever there is smoke, there is fire.
Observation: There is smoke on the mountain.
Conclusion: Therefore the mountain is on fire. (by deduction)

नैयायिकs insist on a unique five part inference process which proceeds as follows:

प्रतिज्ञा – पर्वतः वह्निमान् ।
हेतुः – धूमात् ।
उदाहरणम् – यो यो धूमवान् स स वह्निमान्, यथा महानसः ।
उपनयः – वह्निव्याप्यधूमवाँश्च अयम् ।
निगमनम् – तस्मात् पर्वतः वह्निमान् ।

This roughly translates to:

Statement to be proved: The mountain is on fire
Reason: Because of smoke
Inference-relation with example: Wherever there is smoke, there is fire, just like in the kitchen
Bringing universal proposition to present context: smoke, pervaded by fire, is present on the mountain
Conclusion: Therefore fire is present on the mountain

If you observe keenly, the universal proposition is missing in the inference process! We will soon see why. The core of the inference process is in the two concepts which are unique to Indian logic: **व्याप्ति** and **पक्षधर्मता**. Once we understand these concepts, the inference process will become clear. In the

simplest terms, व्याप्ति is the relation between the object that is observed and the object to be concluded. The observed object is called the हेतुः, which, in our case, is the smoke. The object to be concluded is called the साध्यः, which is the fire in our case. The relation between the साध्य and the हेतु is called व्याप्तिः.

नैयायिकs say that inference must always be preceded by perception. We first perceive that the साध्य and the हेतु are related and define that relation as व्याप्ति. Then, whenever we perceive the हेतु, we remember the व्याप्ति and infer the साध्य. One may ask, "What is point of going into such complications? Why not simply follow the simpler three part inference of the Greeks?" Indeed, not all schools of Indian philosophy feel the necessity of the five part inference either. But the नैयायिकs insist, and they give two extremely elegant arguments as to why all five parts are necessary to make a solid inference. (For details, see (Gupta, 1895))

The first argument consists of a logical error. They say, if we make inference about a particular on grounds of the univeral, the universal already contains the particular and hence, we are entangled in चक्रक (circular reasoning)! The second argument is psychological: If the universal proposition is already in mind, then there is no necessity to infer the particular.

Moreover, they ask: how do we know that "where there is smoke, there is fire?" is universally true? It is impossible to construct any universal proposition. In other words, how do we know that all हेतु is साध्य? Within the scope of our limited

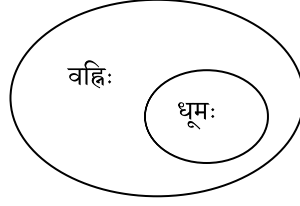


Figure 6.5

observation, there will be many हेतुs and साध्यs among whom we know no relation, and they cannot become the grounds of inference. For drawing any inference, the हेतु and the साध्य must be known to be related, and the relation must be that of व्यापक-व्याप्य, (See Figure 6.5) or in other words, of व्याप्ति. Practically, there is not much difference in the inferences drawn according to western and Indian logic. The difference is philosophical, where Indians lay great stress on व्याप्ति, which has no equivalent in the western tradition.

The second important condition for inference is पक्षधर्मताज्ञानम्. If we see smoke on the mountain, we can infer fire on the mountain only, and not in the kitchen. This fact, that the cause and the effect occupy the same place, is called पक्षधर्मता. Thus, in summary, the inference process is as shown in

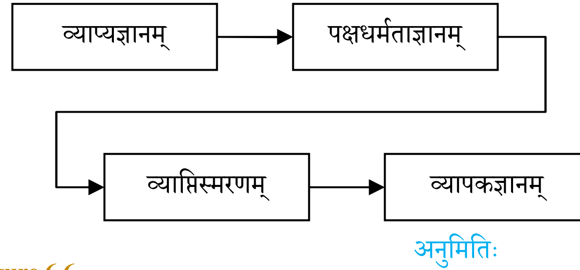


Figure 6.6

Eventually, how do we obtain valid knowledge of व्याप्ति? Either by repeated observation, or from scripture. For example, "यत्र यत्र धूमः तत्र तत्र वह्निः" is an example of व्याप्ति obtained from observation. On the other hand, व्याप्तिs like "यत्र यत्र गोत्वं तत्र तत्र पादेन अस्प्रश्टव्यत्वम्" (Wherever there is cow-ness there is don't-touch-with-feet-ness!) are known from the statements of the Vedas like "गोः पादेन अस्प्रष्टव्या" (REF) (Cow must not be touched with the feet).

This five part inference process is necessary when we are making inference for others (परार्थानुमितिः). When we are making inference for ourselves (स्वार्थानुमितिः), only steps 2, 3, and 4 are necessary.

उपमानम्

The third प्रमाण is उपममानम्. This is very limited in scope, and is used only for identifying new objects based on सादृश्य (similarity). For example, someone describes to you that a "A calm animal with two horns is called a cow". Then whenever you see a calm animal with two horns, you would conclude that it is a cow, by comparing its features with what you were told.

शब्दः

The fourth and final प्रमाण is शब्द. The तर्कसंग्रह describes शब्द as follows:

आप्तवाक्यं शब्दः । आप्तस्तु यथार्थवक्ता ।

Verbal testimony is the speech of an आप्त. आप्त is he who gives correct knowledge through his speech.

In the opening of this chapter, you did not trust the stranger who gave you information about gold because he was not an आप्त! You would have trusted your friend, because you knew from experience that she never lied, and was qualified to be called आप्त! But not if you were a मीमांसक. For मीमांसकs, the prescriptive statements of the वेदs alone constitute शब्द.

Naively, this may seem to be a big paradox. To put in Arindam Chakrabarty's words, "How could autonomous rationality have developed in Indian thought given that most philosophizing was done with an allegiance to the unquestioned authority of the Vedas or some other root-text the truth of which was taken for granted? Where the forces of tradition and verbal testimony are so dominant, how could reason in the Western sense of the term flourish?" (Chakrabarti, 1997)

He goes on to suggest three lines of argument to resolve this paradox. Firstly, not all Indian philosophers accept शब्दप्रमाण. चार्वाक says "प्रत्यक्षमेव प्रमाणम्", for he does not even believe in inductive reasoning. बौद्धs accept only perception and inference. Within the Vedic schools, the साङ्ख्य "very clearly relied on its own variety of reflective reasoning as the sole means of attaining such knowledge as would lead to the pure and permanent cessation of suffering", and for all practical purposes, the साङ्ख्य is a purely reason-based system with its own set of assumptions and coherent arguments.

Secondly, The वेदान्त and the मीमांसा, which accept शब्दप्रमाण and rely much on the Vedas, also rely heavily on reason to correctly interpret the Vedic sentences.

Thirdly, one can question the inherent assumption that reliance on tradition is necessarily irrational. In a way, we can show not only the coexistence of reason and tradition, but also the necessity of commitment to tradition for rationality. Rationality requires social interation, and social interaction requires understanding of, and trust on others' speech. वात्स्यायन asks us to trust others, "be that a sage, a lay Aryan or a mleccha foreigner; unless there is reason to suspect ignorance or deceit or lack of commitment." (Quoted from (Chakrabarti, 1997)).

The cognition through शब्द (word) is ज्ञानकरणकं ज्ञानम् (knowledge which requires prior knowledge as its instrument.) How is the word understood? The भाषापरिच्छेद says

पदज्ञानं तु करणं द्वारं तत्र पदार्थधीः ।
शाब्दबोधः फलं तत्र वृत्तिधीः सहकारिणी ॥ REF ॥

Knowledge of the word is the instrument. Then knowledge of meaning (object) comes to aid. Then comes cognition of शब्द; association of meaning and word (वृत्ति) is helpful in the process.

Let us summarize the four instruments of cognition in terms of the करण-व्यापार-फल scheme:

करणम्	????	व्यापारः	फलम्
प्रत्यक्षम्	इन्द्रियम्	अर्थसन्निकर्षः	प्रत्यक्षप्रमा
अनुमानम्	व्याप्यज्ञानम्	व्याप्तिस्मरणम् + पक्षधर्मताज्ञानम्	व्यापकज्ञानम् = अनुमितिः
उपमानम्	सादृश्यज्ञानम्	उपदेशवाक्यस्मरणम्	उपमितिः
शब्दः	पदज्ञानम्	पदार्थस्मरणम्	पदार्थान्वयबोधः = शाब्दबोधः

Thus are the four प्रमाणs, the means to correct cognitions, the means to dentify harmful and harmless objects in the world, the means to taking correct decisions, and finally, the means to निःश्रेयस.

The human mind has been concerned with questions on the nature of life, the nature of Self, and the meaning of Death since the earliest times. Even in the Indian tradition, the मन्त्रसंहिताs, which are the earliest sections of the Vedas, have the ideas of स्वर्ग, the world of Gods, and पितृलोक, the world of Forefathers. The ब्राह्मणs, which are the ritualistic sections of the Vedas, elaborately describe the cycle of birth and death in accordance with the law of कर्म, which teaches that the next birth is determined by actions done in this birth. Finally, in the उपनिषद्s, we find the most exquisite philosophical ideas that deal elaborately with आत्मविद्या, the Knowledge of the Self, which is seen as the way to liberation from the sorrowful cycle of birth and death.

Traditionally, the ultimate goal of most Indian knowledge systems has always been something metaphysical. Pick up any Indian text and see its goal: Why study grammar? पतन्जलि says, for correct recitation of scriptures (आगम) and protection of texts (रक्षा), before stating the more material use: resolving doubt (असंदेह). Why study astronomy? लगध will tell you in the वेदाङ्गज्योतिष,

वेदा हि यज्ञार्थम् अभिप्रवृत्ताः कालानुपूर्व्या विहिताश्च यज्ञा: ।
तस्मादिदं कालविधानशास्त्रं यो ज्योतिषं वेद स वेद यज्ञान् ॥ ३ ॥
(यजुर्वेदीय वेदाङ्गज्योतिषम्)

The Vedas have indeed been revealed for the performance of sacrifices. But for these sacrifices are dependent on time. Only he who understands the astronomy, lore of time, understands performance of sacrifices fully.

Even in classical dances, the metaphysical aspect of भक्ति is well known.

A twist in the tale comes when, over the years, आत्मविद्या comes to be equated with आन्वीक्षिकी, the science of logic and critical reasoning! Founded by Sage मेधातिथिः गौतमः, the tradition of logic and reasoning goes deep into the period of the ऋग्वेद. From the ancient references to philosophical debates in the court of King Janaka, to the latest writings of the eighteenth century, we find in the tradition, great praise of reasoned inquiry. It is no surprise that Manu uses the two words आत्मविद्या and आन्वीक्षिकी synonymously. Kautilya is all in praise for it when he says in his अर्थशास्त्र:

प्रदीपः सर्वविद्यानां उपायः सर्वकर्मणाम् ।
आश्रयः सर्वधर्माणां शश्वदान्वीक्षिकी मता ॥ १.२.१२ ॥ (अर्थशास्त्र)

The light to all knowledge, the means to all activity, the basis for all *धर्मs*, is the science of critical reasoning; thus is the eternal thinking.

This idea goes so deep in the Indian thinking that not only sciences like medicine, astronomy and chemistry, but also subjective arts like Dance and Drama are subject to reasoning! Is it not a brilliant feat of the Indian mind that logic and

rationality have become so naturally integrated with aesthetics, morality and spirituality that even these are analyzed in the same framework as material sciences? What made this sweet synthesis possible is best shown by contrasting Indian philosophy with western philosophy (Chatterjee, 1912):

Western philosophers regard that metaphysical truths (like the meaning of death, etc) can never be experienced directly by the human mind, and must therefore, be matters of speculation or faith. Thus, the philosopher will start with a certain set of assumptions and derive a theory. He then applies that theory to the external world (either to nature or to society). If the assumptions are challenged, the theory collapses. In this perspective, two schools of thought which describe the same metaphysical truth must be either identical or contradictory, and only one can be exclusively true.

Indian philosophers have always held that metaphysical truths *can be* directly experienced. Thus an Indian philosophical system begins with the founder's experience, and culminates in a technique that anyone can apply to get that same experience. In such a system, even if the assumptions are challenged, the final experience remains unaffected, and another philosopher, with different assumptions, may come up with another technique to get that experience. Thus, each person, following a different philosophical system, experiences the metaphysical truths in the *same way*. It is rightly said:

एकं सद्विप्राः बहुधा वदन्ति ॥ ऋग्वेद 1.164.46 ॥

Truth is one. The wise call it by many names.

This has a profound consequence: the role of reasoning becomes not to invent metaphysical truths via speculation, but to show systematically, the truths that have already been experienced. It was perhaps this view that led to incredible diversification of philosophical systems in India, each teaching the means to end sorrow in its own way. And it is perhaps because of this common thread of experience, that for centuries over centuries, all the schools have coexisted in spite of critical theoretical differences. Instead of being hostile to each other, they have constantly debated and refined themselves.

The most important philosophical schools that arose were the following: The six Vedic schools, which regard the Vedas as valid means of knowledge:

1. न्याय and वैशेषिक
2. योग and सांख्य
3. वेदान्त and पूर्व मीमांसा

Not all schools regarded the Vedas as means of valid knowledge. Most notable of these are the बौद्ध, जैन and चार्वाक. Besides, there are innumerable philosophies stemming from the आगमs and तन्त्रs.

When the tradition of आन्वीक्षिकी diversified, its core ideas of logical enquiry were carried forward most explicitly by the न्याय school. Parallel to the न्याय school, another school that developed was that of the वैशेषिकs. While the नैयायिकs gave importance to प्रमाणs (the means of valid knowledge), the वैशेषिकs gave

importance to पदार्थs (physical matter and sense objects). Indeed, वैशेषिकs may be regarded as the earliest physicists. After a long history of complementing each other, after the 10th century, the two systems began to merge.

In the 12th century, a scholar from मिथिला called गङ्गेश उपाध्याय contributed a key innovation that revolutionized the way people carried out debate. In his text तत्त्वचिन्तामणिः, besides presenting a unified न्याय-वैशेषिक philosophy, he invented a new meta-language for accurate and unambiguous knowledge representation. Debates were commonplace in India at that time, and all philosophers quickly assimilated the new meta-language. So profound was the influence of this text that it came to be regarded as a new school altogether: नव्यन्याय (New न्याय). All literature since the 16th century, be it न्याय, वैशेषिक, वेदान्त, व्याकरण, or even साहित्य and नाट्य, was invariably written in the नव्यन्याय language.

At the advent of colonialism after the eigtheenth century (which continues as western universalism to this day), the popularity of traditional philosophies decreased. Today, once again, नव्यन्याय is seeing a resurge, through modern applications in compulational linguistics, natural language processing and cognitive science. There is increasing need for people from a scientific background to learn from the traditional masters, and for traditional scholars to get acquainted with the latest findings of modern science. A dialogue, nay, a collaborative research by scientists and scholars is sure to give many fruitful insights into hitherto unanswered (and even unasked) questions.

Images:

Rope
http://swamishivapadananda.typepad.com/swami_shivapadananda/maya_or_illusion/

Pot

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